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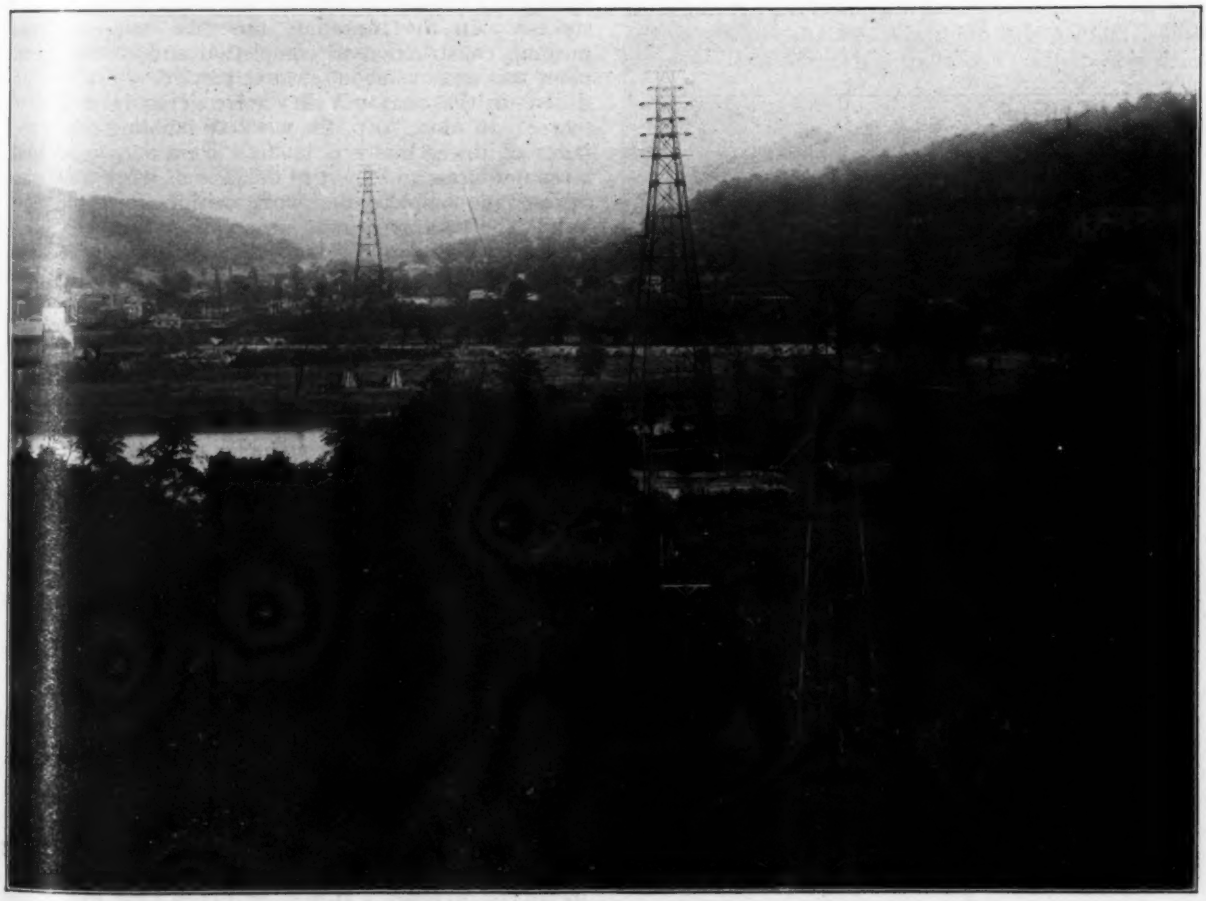
Transmission - Line Construction of Duquesne Light Company

An Account of the Difficulties Met With in Building a 66,000-Volt Line Through Mountainous Region

By THOMAS R. HAY

On account of the rapid growth of the electric load in the Pittsburgh district, the management of the Duquesne Light Co., early in 1915, became impressed with the necessity for higher voltage main-line transmission circuits than were at that time in operation if this rapidly increasing load was to be satisfactorily handled. After a study of the existing conditions and of the probable growth and extension of the system, a potential of 66,000 volts for all main trunk lines, with local transmission at 11,000 and 22,000 volts, was decided on.

About January 1, 1915, a contract was negotiated with a large tube mill about 15 miles below Pittsburgh, on the north side of the Ohio river, for a load of about 2000 hp., with prospects of later large increases. Estimates and plans for serving this installation were in preparation when negotiations were actively opened for the acquisition of the property of



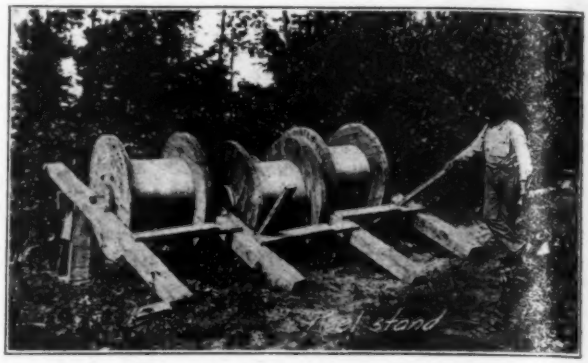
Transmission Line of Duquesne Light Co., at Ambridge, Pa. 66,000-Volt River Crossing.

the Beaver County Light Co., situated 25 to 30 miles south of Pittsburgh, and also lying to the north of the Ohio river. While these negotiations were pending and as a result of a detailed study of conditions in the Beaver Valley, it was found that in case the negotiations in question were satisfactorily concluded it would be necessary to take immediate action to provide improved service in this district. The local facilities were already inadequate and as a result of aggressive sales activity the load was rapidly increasing, thus further aggravating this already unsatisfactory condition. To remedy matters it was decided to construct a high-tension steel-tower transmission line from the Brunot's Island power station of the Duquesne Light Co. at Pittsburgh to a central distributing substation about 30 miles distant and located at the approximate center of the territory of the Beaver County Light Co.

The company's engineers immediately started on the design of a transmission system that would meet the existing requirements in the Beaver Valley and that would be adequate to take care of future demands in the Ohio and Beaver river districts. The final decision was for a steel-tower line to accommodate two circuits consisting of No. 4/0 copper wire to be carried on suspension-type insulators at a potential of 66,000 volts, three phase. The towers are made of angle-iron steel, have an average height of 75 to 80 ft. and an average width of base at ground line of 25 by 25 ft. They are spaced at an average of 600 ft. apart with maximum spans of 1700 ft. at the crossings of the Ohio river at Ambridge and at Fern Hollow at the south end of the Sewickly bridge.

Survey for the right-of-way was started over two routes, one on the south side and the other on the north side of the Ohio river. It immediately became apparent that difficulty would be encountered in routing the lines out of Brunot's Island, due to the location of the Island within the city limits. Valuable residence and business property surrounds it on all sides for a distance of at least 1½ miles. After several months of hard work the route on the north side of the Ohio river was finally abandonded and all

Tower Foundation for River Crossing. Wood Pole 22,000-Volt Line.

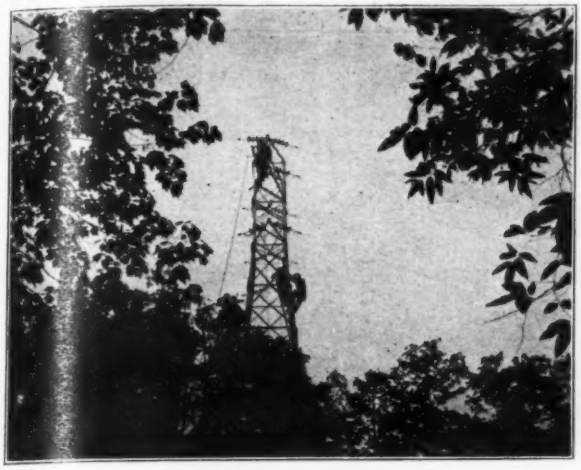


Reels Set Up for Use in Stringing Copper.

energy transferred to the south side of the river. Within 9 months, or about the beginning of 1916, the right-of-way from the southeast borough line of McKees Rocks, on the south side of the river and directly across from Brunot's Island, to Ambridge Borough, a distance of 12½ miles, had been completed. There yet remained, however, two miles of right of way to be secured from the McKees Rocks end of the line back to the Island. Several attempts were made to wind a way through, but without much success. In the meantime the tube company was pushing construction to completion and the management was anxious about electric service. Service conditions in the Beaver Valley were going from bad to worse. In May, 1916, the work of building this 12½ miles of tower line was let to a contractor who had a reputation as an expert in this line of work and who agreed to complete the work within four months. While the contractor was proceeding with the job a temporary line was constructed from Brunot's Island, through McKees Rocks, to the first tower location. Two No. 1/0 circuits were installed to be used for 22,000 volts. Energy at 22,000 volts was to be delivered temporarily along the pole and tower transmission lines to the tube mill until such time as the tower line could be completed throughout into Brunot's Island.

On account of the roughness of the route, over which the line is constructed (a route considered one of the worst east of the Rocky Mountains), the contractor had trouble distributing his materials and in housing and holding his men. On Nov. 1, 60 days after the time limit, the contractor had all the towers erected and 10% of the wire strung. But by this time he had become disgusted and left for parts unknown. The distribution department, of the Duquesne Light Co. was called to the rescue and took up the work where the contractor left off. This was on November 9, 1916. Not much progress was made during the first week or ten days as there was no one in the organization who had had any experience in this kind of work. However, as a result of the co-operative spirit of all of the men called on to assist, the matter was soon in hand, and good progress was being made although satisfactory progress was much retarded by inclement weather. It will be noted that this work was taken over at the beginning of winter. On Feb.

1, 1917, the line had been completed to the Ambridge substation, but, due to the delay in receiving transformers and switching materials, service was not supplied over this line until some time in August, 1917. This delay in furnishing service did not particularly



Connecting Wire to Insulators.

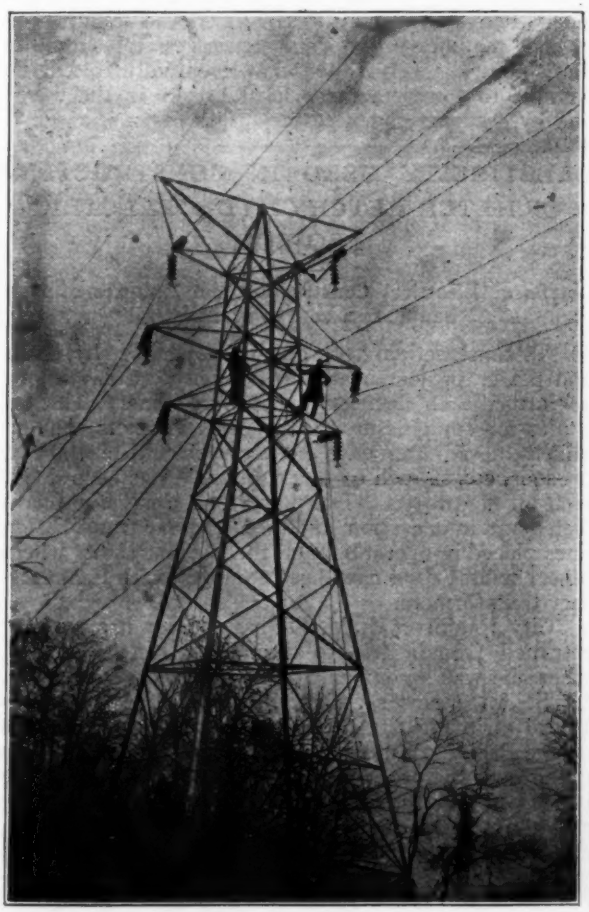
inconvenience the tube mill, as construction had suddenly ceased, but the Beaver County Light Co. was still in urgent need of some sort of immediate relief. Due to delays in the construction of the tower line from Ambridge to Junction Park, a temporary 22,000-volt line was installed on the poles of the Beaver Valley Traction Co. and was placed in service in September, 1917. By this means the Beaver County Light Co. was somewhat relieved to the extent of about 800 kw.

While construction work on the tower line was under way, negotiations were being carried on with the Pennsylvania Railroad Co. for the use of its right-of-way known as Duff's Branch, which runs past the rear of the Esplen substation of the Duquesne Light Co. in McKees Rocks and past the point to which the tower line had been completed. It was fully 18 months from the time the application for permit to use the railroad right-of-way was made until the executed papers giving the necessary authority to proceed, were received. No time was then lost in the erection of the line along this right-of-way and in January, 1918, current at 66,000 volts was being transmitted from Brunot's Island to the substation at Ambridge, where it was converted to 22,000 volts for transmission to the tube company and to the Beaver County Light Co. at Rochester. Service at 66,000 volts from the Brunot's Island plant to the Junction Park substation was established about January 1, 1918. The temporary 22,000-volt line, mentioned above, was kept in service to feed customers along its route, and also to supply emergency service to the Rochester substation, about two miles from Junction Park.

One of the many peculiar features in connection with this 66,000-volt line, is that the initial voltage transmitted over it was 110 volts direct current. This occurred in Moon Township, below Coraopolis, on the Ohio river, and was made necessary by a clause in the franchise agreement at that place which required that the line in the township should be in operation, supplying current to a regular customer, by a certain date. The source of this supply was a set of batteries installed on electric trucks. This direct-current service was in use for about 30 days, but after the completion of the tower line and of the local substation energy for this connection was transmitted over one circuit at 22,000 volts. A step-down transformer was placed at the nearest convienent point and energy taken at 2200 volts to the point of usage, three miles distant.

The two river crossings at Esplen (McKees Rocks) and Ambridge were especially difficult to install. At Ambridge one of the towers is 252 ft. above the ground while the other is 212 ft. in height. As none of the men had ever before worked at such a height, they were at first very timid, but after working for a time they soon gained confidence. Just as the work was beginning to proceed satisfactorily, the river commenced to rise and the current became so swift that it was not possible to safely operate the boats necessary for carrying the conductors across from one side to the other. Work was discontinued for 10 days until conditions had become normal after which the crossing was completed in one week's time. Another difficult feature was the crossing of the Fort Wayne (P. R. R.) at Ambridge. There were only certain periods of the day when the wires could be taken across and even at these times it was necessary to flag from two to three trains. As a result of this condition what would normally have been a job of about six hours, required one week. All of this work was done in the middle of January when the thermometer was near zero. On account of the prevailing atmosphere conditions at this point, it was practically impossible, during the entire period of construction, to see across the river.

Shortly after the Brunot's Island-Ambridge line



One of the 66,000-Volt Steel Towers.

was completed, the second leg of the line from Ambridge to Junction Park was ready for the copper. The crew was transferred to the Beaver Valley and insulators placed and wire strung. The length of this leg is 13 miles. The route is through country that is not as rugged as that of the Brunot's Island-Ambridge line, and, as a result of the experience which the men had gained, rapid progress was made. An abundance of power from this tower line is now being supplied to the Beaver Valley for all purposes.

Another leg of this transmission line which is the last so far completed, starts at a point known as Wact Junction, about two miles north of the Ambridge substation and back in the country from the Ohio river, and runs in an easterly direction for about 27 miles to Cheswick Borough, northeast of Pittsburgh on the Allegheney river. The towers for this line were also designed by the distribution department of the Duquesne Light Co. This line is very similar to the one described in the foregoing except that it was only necessary to pull in one circuit. This gives sufficient line capacity to handle the existing load in the Allegheney Valley. At the present time there is only one connection, the West Penn Power Company. This customer is at the extreme end of the line and has a demand of 10,000 kw. There has been installed on this tower-line extension a special 22,000-volt three phase circuit consisting of three No. 0 wires located on a special arm placed below the 66,000-volt lines. This circuit is to supply a large coal operation, located a distance of about 5 miles from Cheswick.

No unusual features were encountered in the construction of the Wact Junction-Cheswick and Wact Junction-Ambridge lines excepting right-of-way trouble in two spots. This necessitated the building of special temporary wooden structures to surround these points. It is hoped that eventually it will be possible to complete these local breaks in the tower line by securing the necessary right-of-way.

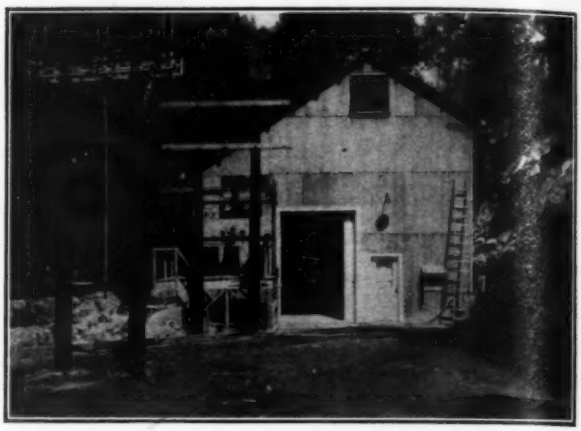
ELECTRICITY USED IN CONSTRUCTION OF HETCH HETCHY HYDROELECTRIC PROJECT.

Details of Electrical Construction and Features of New San Francisco Power Station.

All construction work on the Hetch Hetchy water and power project near San Francisco, Cal., will be performed with electrically driven machinery. This includes air compressors, hoists, rock crushers, cement mixers, aerial tramways, concrete placing machinery, dredges, etc. Much of this equipment has been delivered on the project. The power house has been completed and in operation, and the necessary transmission lines placed in operation, and the various points where power will be used have been equipped with the necessary transformers.

City Engineer M. M. O'Shaughnessy has recently returned from a trip to the Hetch Hetchy Valley, where he was accompanied by Maj. George F. Sever, U. S. A., engineer assigned by the War Industries Board to investigate the efficiency of power activities on the Pacific coast. Major Sever spent three days in going over the project and expressed himself as being impressed with the magnitude of the city's undertaking and the efficient manner in which the work is being conducted. A personal inspection was made of each plant including Lake Eleanor and the recently completed dam. This plant is capable of generating 4000 hp.

This is much more than the city will use in its construction work. Under orders from the State Power Administrator Butler of the Railroad Commission, the city is selling its excess power through a connection near Triest's with the Sierra Power Company's lines, for which the city will net a minimum of $50,000 a



Power House at the East End of Early Intake, Exterior.

year and at the same time help relieve the present situation of fuel shortage.

This project will cost approximately $11,000,000. The completion of the mountain division will produce approximately 66,000 hp., from which a revenue will be derived which should be enough to pay interest on the mountain outlay and relieve the taxpayers of any burden from this portion of the project.

The first permanent construction to be undertaken in this project, aside from the necessary roads, railroads, temporary power plant and transmission lines for the construction work, and Eleanor dam for supplying water to the power plant, consists of the construction of the Hetch Hetchy dam, and a pressure tunnel 10½ ft. in diameter, which will pass through the solid granite mountains for a distance of 20 miles to the permanent power house at Moccasin creek, where 66,000 hp. will be developed. Men are now at work on the Hetch Hetchy dam and at various points

Interior View of Early Intake Power House.

along the tunnel. The dam will be located on the Tuolumne river at a narrow gorge at the outlet of Hetch Hetchy Valley. The structure will be of the heavy-masonry type, 300 ft. high and 800 ft. long, and will impound 112,000,000,000 gal. of water.

Until it becomes necessary to develop the second unit of electrical power, the water will be allowed to flow down the natural channel of the Tuolumne river to the Early intake. At this point an overflow dam will intercept the water released from the Hetch Hetchy reservoir and divert it into the pressure tunnel previously mentioned. This tunnel will be a part of the permanent main aqueduct. After passing through this tunnel the water will flow into a forbay reservoir of 2000 acre-ft. capacity, thence to the Moccasin Creek power station.

From this point to San Francisco is 141 miles, and the water will be carried this distance after passing through the turbines at the Moccasin Creek power house and will supply the city with water for all purposes.

Whenever the upstream 12 miles of aqueduct between the Early intake and the Hetch Hetchy dam is built, another drop will become available just above the Early intake. At this power house there will be a net drop of 1325 ft.

There are approximately 31 miles of transmission lines, extending from the power house to the Early intake to the various points where power is to be furnished for construction purposes. The poles for the

Transformer Installation at Early Intake.

transmission line are from 35 to 50 ft. in length, made of native grown cedar and cost a trifle less than $2 each. In crossing canyons long span construction is necessary. An A-frame is used at each end of the span supporting ⅜-in. galvanized strand wire. In this way spans were made to cross places 2000 ft. in length. At the Hetch Hetchy dam site a tramway with three rails and pass track in the center is operated by a 75-hp. motor. It is 3800 ft. long and rises 1700 ft. It is used for delivering material from the railway above to the dam site in the valley below. At the dam site there are three 400-kv-a., 440-volt transformers. All power is 440 volts, 3-phase, 60 cycles. The lighting is 110-220 volt, single phase, and is furnished by separate transformers. For lighting the heading in the tunnels special reflectors have been constructed, each reflector carrying five lights, is equipped with wire guard, and can be hung from roof or side of the tunnel or laid down on the floor. These reflectors are equipped with 100 ft. of reinforced lamp cord so that they may be removed to safety when any blasting is going on.

The equipment of the power house consists of three units of turbines operating at 720 r.p.m., direct-connected to 1000 kv-a., 2300-volt, 3-phase, 60-cycle generators of 1500 hp. each. The voltage is stepped up through a single bank of transformers to 22,000 volts for transmission to the various substations.

The pressure pipe line connecting the water wheels with the forbay is 530 ft. in length and 42 in. in diameter, ranging in thickness from 3/16 to ⅜ in. The water wheels operate under a maximum head of 346.5 ft., including a draft head of 15 ft. Water for this installation is diverted from Cherry creek into a conduit of 200-second-feet capacity, 3.3 miles long, consisting of open ditch, flumes and tunnels.

CONTINUOUS METER-READING SYSTEM AIDS APPLIANCE SALES.

Harrisburg (Pa.) Light & Power Co. Shows Progressiveness by Adopting This and Other Up-to-Date Methods.

Several of the smaller central-station companies throughout the country have recently adopted the continuous meter-reading system, which is commonly used by the companies in large cities. Under the old system all the meters were read and billed on one or two days each month. This meant that the discount-day for all customers fell on the same day, usually the 10th of the month. On this day and the days immediately preceding it, the offices and display rooms of the company were so crowded with people that the office force were too busy to sell any appliances. During the remainder of the month, however, the salesrooms were empty.

Under the new method the discount days are extended over the entire month with the result that a more even distribution of customers is obtained which gives the clerks time to try and interest the customer in the appliances that are being displayed. This is certain to produce a considerable amount of business which otherwise would not be developed.

Among the companies that have recently adopted this method of billing with considerable success is the Harrisburg (Pa.) Light & Power Co. This plan worked in conjunction with a save-by-wire selling campaign, has thus far exceeded the fondest hopes of the company officials. Washing machines, vacuum cleaners, etc., are being sold as fast as they can be delivered from the manufacturers.

This company also recently adopted a new fuse policy. The free renewal of burned-out fuses is discontinued. Where it is necessary for the trouble-man to call at the customer's premises to install a fuse, a charge of 40 cents is made. This covers the cost of one fuse only, any additional fuses are charged for at the rate of 10 cents each. This has reduced the number of trouble calls considerably and put the trouble-man on a self-supporting basis.

NEW LIGHTING EXTENSION METHODS.

R. L. Baker, engineer for electrical operations of Henry L. Doherty & Co., has given the details of a new method of making lighting extensions in Ohio. This system, devised by Milan R. Bump, chief engineer, has received the approval of the Ohio Public Utilities Commission and has been filed by the Alliance Gas & Power Co. Other Doherty properties in Ohio will probably follow suit.

The plan, briefly, is as follows: Each new customer prepays the full cost of the extension at 1918 prices; the company pays back the 1914 cost of construction by returning to the original extension customer $20 for each additional customer within 10 years.

Care and Operation of Electric Motors in Factories

Proper Maintenance of Special Timely Value—Good Motor Location Important—Points on Maintenance of Direct-Current, Induction and Synchronous Motors

By JOSEPH P. COLLOPY

At these times when every available machine should be running at its fullest capacity, costly breakdowns are liable to be more numerous than usual on account of the severe service. Although the electric motor is one of the most dependable machines under all conditions that we have, it must receive some degree of attention. Too often we see a motor installed with little care taken as to its setting or alinement, a little oil being poured in the bearings and no further attention given it until "something happens." This policy always proves costly in the end.

The electric motor does not require the same degree of attention as the steam engine, but a little careful watching will pay well, especially at these times. The amount of attention necessary is determined by the type of motor, its size, the kind of load, and to a large extent upon the surrounding conditions. A motor in a hot, dusty location will require much more attention than one ventilated with a good supply of cool, clean air.

General Suggestions as to Motor Location and Maintenance.

In most cases a substantial wall bracket makes a very good mounting for a motor with belt drive. It is up out of the way, taking up no floor space and less subject to dirt and other accidents than if placed on the floor. At the same time it is easily accessible for oiling, cleaning and inspection, and for this reason is preferable to a ceiling mounting. However, a wall bracket is not always available. Care should be exercised in mounting a motor near the ceiling in a warm shop or over a boiler or furnace on account of the motor becoming too warm. A heavily loaded motor will get dangerously warm in a short time under these conditions and should be removed to a cooler location or cooled in some way.

Fig. 1.—Mechanical Appliance Co.'s Vertical Motor Running at 3600 R.P.M. and Driving Woodworking Machinery. Special Base Used for Mounting.

A commutator motor requires better maintenance conditions than a motor without commutator, but the conditions that the commutator motor demands will do the induction motor no harm. Water and oil, especially the latter, are harmful to the windings of both. The bearings of both must be kept free from dirt and grit. A commutator must be kept as free as possible from all foreign substance. It is often impossible to place a commutator motor so that it is free from dust. If it is a totally enclosed type, provided with a supply of air from the outside, a little dust will not prove so objectionable. An induction motor will stand considerable dust, but it should be kept out of the windings as much as possible and special attention given to the bearings. A sheet iron housing built over the motor and provided with a lid so that frequent inspection is not hindered is often found effective for open-frame direct-current motors.

After it has been decided that the motors are located satisfactorily, a method of careful and systematic inspection should be established. A system of inspection that would be ample for one installation would not be adequate for another. Direct-current motors require inspection more often than induction motors. Synchronous motors are generally comparatively large and require closer watching than the induction motor. Direct-current motors with commutating poles do not require the close attention that those without do. If it is an old installation, a survey of the breakdowns that have happened in the past and the number of shutdowns that were avoided by a chance inspection will give a good basis to work on. In a new installation inspections at the first are liable to be too far apart, but a few bad burnouts will point out the need of careful and systematic inspection.

All motors should be thoroughly examined in the morning or at the beginning of a shift. The condition of the bearings should be determined; commutators should be wiped off and any tendency toward the cutting of grooves should be noted and promptly remedied. In the average installation of direct-current motors, an inspection every 2 hours, that is, 4 times during an 8-hour day, will not prove superfluous. Twice a day will generally be often enough for squirrel-cage motors, while synchronous motors require more attention depending upon their size, the voltage regulation, etc. Bearings should be filled with oil each week. Occasionally the old oil should be drained out and replaced by new. The dust that has collected around the bearing and on the frame should be wiped out at each inspection. This will tend to keep dirt out of the bearings and windings. Attention to this matter reflects credit upon the inspector and adds to the general scheme of careful operation.

This amount of care may seem unnecessary for the present-day motor. However, when we totalize the increased production induced by steady running, with the difficulty of securing deliveries on motor parts, and the recent periodical increases of ten per cent on the price of new motors, there are not many installations in which it will not pay. A careful system of inspection is not as expensive as it may appear, for it is possible for one electrician or an apprentice to take care of a large number of motors in this way.

Care of Direct-Current Motors.

The commutator of a direct-current motor requires more attention than any other part. If a commutator has a smooth glossy surface and a dark-brownish color on the entire face, the commutator is all right and it should not be touched except to wipe the dust from it and occasionally to use a small amount of paraffin, vaseline, or light oil applied with a small bit of cloth or waste.

Sparking at the brushes is due to one or more causes. There are some twenty-odd causes, of which the most common are enumerated below.

1. Dirt or grit on the commutator.
2. High mica.
3. High commutator bars.
4. Brushes not properly fitted to the commutator.
5. Brushes not moving freely in holders.
6. Brushes not set at the commutating point.
7. Open or short-circuited armature coil.
8. Incorrect kind of brush.

If sparking is due to the first cause, it may be remedied by wiping the commutator clean. When the sparking continues something else must be tried.

High mica may be detected by carefully running the thumb nail on the surface of the commutator while at rest or turning very slowly. The high mica can be felt above the copper. If the mica has been high for some time, the commutator bars are burned on one edge across the brush path due to arcing.

Several different methods are used for removing high mica. If sparking has continued for some time, the commutator will generally require refinishing by cutting down or grinding. The mica of slow-speed commutators can be cut down enough by using a chisel-shaped tool made from a small three-cornered or square file about 3 inches long. The tool should be ground to the proper shape and size and the mica scraped out with it. A small box square makes a handy guide for this work.

Commutators on high-speed machines can be cut deeper than the slow-speed machines and should be cut in some other way. Where a large number of commutators are to be cared for, a special machine is often used. In these machines a small milling tool slightly wider than the mica is run along each piece at the proper depth. The slots should then be finished off with a scraper similar to the one mentioned above.

When the number to be treated will not warrant the expense of a special machine, slotting can be done quite satisfactorily in a common turning lathe. To slot a commutator in a lathe, place the armature between centers with the pulley end next to the tail stock. It is generally found convenient to place a lathe dog on the shaft in order to steady it. A tool should be ground with a chisel point slightly wider than the mica, and placed in the tool rest. After adjusting the tool so that it will cut at the desired depth it should be moved steadily along the length of the commutator by turning the feed by hand. The tool must be guided in the slot by turning the armature slightly in either direction. If the armature is clamped tight and an attempt made to run the tool through without guiding, failure is bound to be the result.

The amount that the mica should be cut down varies with different conditions. If the speed of the commutator is low the mica should not be cut more than 1/64 inch on account of the dust not being thrown out. Where the speed is high and the commutator is subject to a large amount of dust, the commutator can, and in most cases should, be cut 3/64 inch deep.

Fig. 2.—Steel-Mill Installation, Showing Control Resistors Located Beneath Switchboard and Out of Way. Rapid and Careful Inspection Is Made Possible.

In some installations a three-cornered file is used and a V-shaped slot cut in the mica. Dirt will not collect so readily in a slot of this type. In some slow-speed machines the mica is cut low and a coat of hard, quick-drying, insulating varnish applied. This keeps the dirt from collecting in the grooves. This varnish cannot usually be applied to V-shaped slots on account of it not adhering very well.

The writer has seen a commutator that was subject to lime dust give a great deal of trouble on account of sparking at the brushes. If the commutator was wiped clean it would run normally for a few minutes and then gradually grow worse again. The mica was kept level or a little below the copper at all times, but the sparking did not cease until the mica was cut down a full 3/64 inch.

High commutator bars are detected by the quick upward movement of the brushes. Some article, such as a pencil held close to the brush, will aid in the detection. High commutator bars are generally due to a loose commutator which should be remedied, by driving the high segment back into place and tightening the bolts.

Sparking may be due to the brushes not being well fitted to the circumference of the commutator and thereby causing too high a current density in the contact area of the brushes. This may be remedied by

drawing a piece of No. 00 sandpaper back and forth between the brushes and the commutator, taking care to hold both ends of the sandpaper down close to the commutator while drawing it through.

After long hard usage a commutator will sometimes develop flat spots, grooves running around the circumference, pelting due to sparking, etc. If these items are developed to a great extent the commutator should be turned down until a smooth surface is produced. If the motor is small, the commutator can be treated most satisfactorily in a lathe, where a fine, even cut at high speed should be taken off. If the commutator is on a large machine, it can be repaired without being removed by a special tool, many of which are on the market.

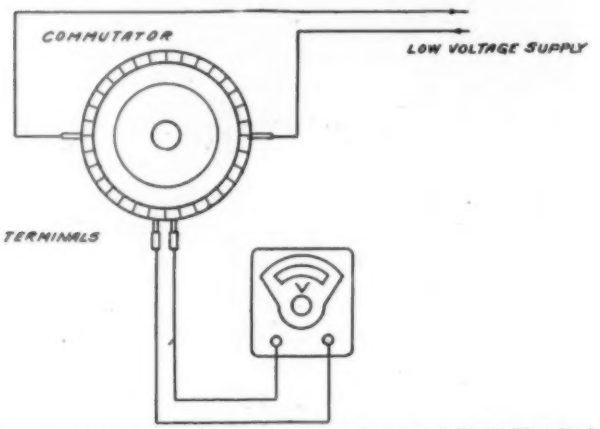


Fig. 3.—Voltmeter Method of Locating Open and Short-Circuited Armature Coils.

If the commutator is roughened by sparking only, it is often possible to remove this by smoothing the commutator while it is being revolved slowly by some external means. A small motor can often be revolved by means of a portable air or electric drill. The best thing to use for smoothing is a commutator stone of good texture. Gritty substances, like sandpaper and especially emery cloth, should not be used on the commutator, if possible, because they usually scratch the surface more or less instead of smoothing it.

If the brushes stick in the holders or there is not enough pressure on the brushes, violent sparking is liable to occur. A little adjusting will generally correct this. Care should be taken that no more pressure than necessary be applied in order to save the brushes from excessive wear and to save the power loss due to excessive friction. Brush maintenance is the most expensive item in connection with direct-current motor maintenance and everything should be done to make it a minimum.

A point on the commutator can always be found at which there is the least tendency toward sparking. This point for a motor without commutating poles is slightly back of the neutral line and can generally be found by adjusting while running. On motors that are being constantly reversed, or commutating-pole motors, the neutral points must be determined more exactly. An accurate way of determining the neutral point of a commutating-pole motor is as follows: The motor should be driven by some external means. A voltmeter is now connected across the brushes and the commutating poles separately excited with a constant current. The brushes should be shifted until there is no deflection of the voltmeter. When the brushes are in this position they are in the neutral point.

Another way of determining the neutral point, when it is not convenient to revolve the armature, is to separately excite the commutating field through a switch that may be conveniently opened and closed. Connect a voltmeter across the brushes; move the brushes until a point is reached where there is no deflection of the voltmeter when the circuit is opened and closed. This is the neutral point for the brushes. When the neutral point is once found it should be marked so that it will not have to be redetermined in the future.

If it is suspected that sparking is due to an open coil it can be easily tested as shown in Fig. 3. A source of current is applied across the armature as shown, the field circuit being disconnected. Current will flow through only one side of the commutator if there is an open coil. The voltmeter, when across the coils on the dead side, will show no deflection until it comes across the open coil. Full voltage will then be deflected.

If the sparking is quite violent and a ring of fire seems to follow the commutator nearly around, it may be taken as a sign of an open coil.

A short-circuited coil that is causing bad commutation can generally be located on account of its high temperature. It will often burn apart and cause an open coil. To locate a short-circuited coil in a machine, use a method similar to the one shown in Fig. 3. The low-reading voltmeter, when placed across the different segments will show an equal deflection until it is placed across the short-circuited coil when it will show little or no deflection. This method is not always practical with the instruments at hand, since a voltmeter with a scale of 0-3 or lower will usually be required.

If the insulation fails in a field coil it may often be repaired without removing the field coil, but the work must be done carefully. When found necessary to remove the coil and it is to be out only a short time, a jumper may be connected in its place and the motor will run, that is, if it is a machine of 4 or more poles and wave wound. The coils will heat up much faster this way and precautions must be taken that the coils do not reach a temperature much above 100 degrees. It is also possible to place a jumper around an armature coil but this should be regarded as a temporary measure, only for an emergency that can be immediately taken care of.

The Care of Direct-Current Starters and Controllers.

The control for direct-current factory motors can generally be divided into three classes, the resistance starter, the drum controller and the magnetic controller.

The ordinary resistance starter is something that should be handled with considerable care and it is indeed very difficult to induce the average workingman to do this. Where a motor must be started and stopped often by unskillful hands, automatic starters prove to be an economical investment.

The different contacts should be kept smooth and in good condition. All connections should be kept tight and any moving parts should be kept as free from dust and foreign matter as possible. The starter should receive periodical attention, the same as the motor. One often sees the arm of a resistance starter held in place by a string or a piece of wire. If a starting arm will not stay in place, there is a reason why it will not and it should be determined. An electromagnet energized by the field current is generally used to hold the starting arm in the running position.

If some connection of the field circuit, either in the starter or the motor, becomes loose, the field current becomes weakened and likewise the electromagnet. If the starting arm is tied into the running position, the motor may run away on light load or be in danger of overheating on full load.

The drum controllers such as used on hoists, cranes, transfer cars, etc., are quite rugged and generally cause little trouble if a little periodical attention is given them. There are three things in the main that should be done. They are: Keep the connections tight; see that the contact fingers bear down with the proper tension, and that the different parts are properly lubricated. The bearing pressure should be between 2 and 6 pounds, depending upon the size of the contacts. The proper tension can roughly be determined by testing the pull with the fingers. It is quite important to see that the contacts are properly lubricated but not in excess. A small amount of machine oil properly applied will reduce the wear and keep the contacts in good shape.

Magnetic controllers are not difficult to keep in running order, if they are examined systematically and regularly. Any dirt or excess oil should be removed and the contacts smoothed with a fine flat file. Any loose electrical connections or mechanical parts should be tightened. The different springs should be kept at the proper tension. The mechanical parts should work freely and parts that are bent or badly worn should be removed. A small quantity of lubricating oil is a great help in keeping the different parts moving freely and reducing rust and wear. Men using magnetic controls should be cautioned as to the trouble caused by unnecessary manipulation simply to "hear her pop." This is especially true of controls with dynamic braking.

Care of the Squirrel-Cage Induction Motor.

It has been said, and well said, that the squirrel-cage induction motor is to the commercial world what the mule is to the army. It is indeed quite reliable, rugged and will stand a lot of rough handling. It is not a constant-speed machine, nor does it permit the refinement of control possible with the direct-current machine, but is built for rough, dependable service.

However, the induction motor cannot be neglected entirely and a little time spent regularly and systematically will prove economical and sometimes quite necessary. The part of an induction motor that needs the closest inspection is the air-gap clearance. The clearance is necessarily quite small, varying from about 0.05 of an inch on the larger sizes down to 0.015 inch for the smaller. This does not give much room for wear. When the air gap is equal on all sides of the rotor, the magnetic pull will be the same, but if the rotor is permitted to drop down, the forces are unbalanced and the tendency of the rotor to rub on the bottom is increased. The air gap should be tested regularly with a gauge. Sometimes a rotor shows clearance enough at standstill but on starting or heavy loads the shaft will be deflected enough to permit the rotor to rub. This can be verified by sighting through between the rotor and stator, a mirror being necessary in some cases.

The windings of an induction motor, the same as with other motors, should be kept as free as possible from oil, water, dust and all other substances that are detrimental to the life of the windings and the successful operation of the motor.

The bars on the rotors become loose at times and must be retightened or low speed will be the result, and in addition there is danger of the loose bars rubbing on the stator. In the old type of machines the rotor bars were carefully insulated from the rotor. It has been found in practice that it makes little or no difference whether the bars are insulated from the rotor or not.

If one of the coils of a Y-connected induction motor burns out, this cuts off one lead and the motor runs single phase and very erratically. On some installations the motors are protected from single-phase operation by a special relay or an accurate setting of the overload relays. This can often be determined by the change in sound of the motor when it begins to operate single phase. It may also be indicated by the blowing of the fuses on account of overload on the single phase. A failure to start accompanied by a buzzing noise is an indication of an open circuit.

The phase that is open-circuited may be determined by an ammeter. A little careful inspection will generally locate the faulty coil. If possible, the coil should be repaired or replaced before restarting. If it is absolutely necessary to run the motor before repairing the coil, a jumper can be used. When putting in a jumper, both ends of the coil should be removed and taped so as to prevent a chance of current flowing through them. If the coil is to be left out of service for any length of time, it is best to remove a corresponding coil out of each phase, thus preventing the unbalancing of the motor and the formation of cross currents. Coils should not be left out any longer than necessary, as it has the same effect as raising the voltage and overheating is liable to be the result.

One of the most important things to watch in the operation of induction motors is the voltage. The torque of the motor varies directly as the square of the voltage. A heavy drop in voltage will slow the motor down and cause it to become dangerously warm. Where an induction motor is operating constantly at full load an increase in the line voltage of 10 per cent will often prove beneficial. The voltage between phases should be kept as nearly equal as possible. Unbalanced voltage is one of the causes of the faulty operation of induction motors which is very often neglected.

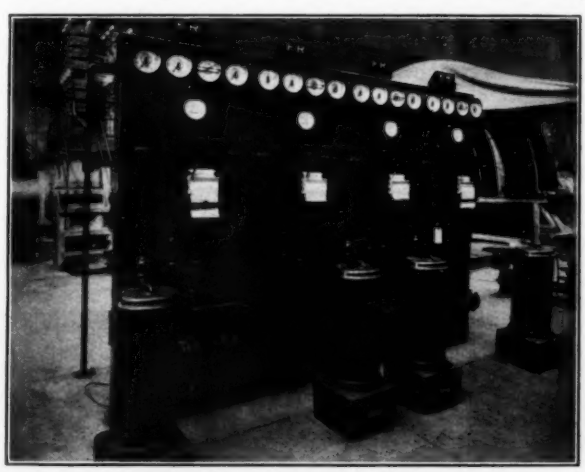


Fig. 4.—Arrangement of Master Switches, Switchboard and Resistors for 500, 600, 3000 and 6000 HP. Motors. A Neat Installation Encourages Careful Operation.

The squirrel-cage motor of the size commonly used in factories is generally started by a compensator which connects the motor across approximately one-half line voltage. No fuses or overload relays are used in starting. These compensators are a simple, compact unit and do not cause a great deal of trouble.

However, they are not as free from trouble as the motor itself and whenever the motor balks, the compensator is a very good place to begin to search for the trouble. Quite often the contacts become damaged and one or more of the leads become disconnected. At other times the undervoltage and overload relays become out of order and cause trouble by breaking the circuit at unnecessary times.

Quite often a motor and compensator are connected up so that the line voltage is stepped up for starting instead of being reduced. One can easily see that this will not work very satisfactorily, but it is a condition that often is not detected by inspectors supposed to be experts.

Where automatic or drum control is used for induction motors, the same points mentioned under the care of direct-current motors will apply.

Operation of Slipring Induction Motors.

The operation of the slipring induction motor is much the same as the squirrel-cage motor, except that the wound rotor and sliprings will require a little more attention.

The brushes on the sliprings should be adjusted so that grooves will not be worn and so that they are well fitted to the ring at all times. If a coil in the rotor is short-circuited or open, there is liable to be trouble at the brushes. The most practical way to find a short-circuited coil is by its high temperature. The motor should be run long enough to locate the coil in this way. If a coil becomes open, causing the motor to run with only one or two phases closed in the rotor, reduced speed will be the result and the motor will get dangerously warm in a short time under heavy load. If a motor with one lead of the rotor open is started from rest, it will lock at half speed.

Care of the Synchronous Motor.

Only a few years ago one could almost disregard the synchronous motor as a factory drive of any importance on account of its low starting torque, hunting, high maintenance, etc. The synchronous motor has been improved considerably and is now often used for driving pumps, air compressors, blowers and many other places where a motor larger than 100 horsepower is required. Although the starting torque of the new synchronous motors has been greatly improved, it is not advisable to use one where frequent starting and stopping is necessary.

The points of general care and inspection that apply to direct-current motors and induction motors will apply to synchronous motors, except that the latter will require a little more careful attention than the others perhaps.

In starting a synchronous motor, it should be as free from load as possible. If the motor is of an old design, it is liable not to start with any of the load connected. No field current should be applied when starting. The flux that starts the motor as an induction is not the flux that keeps the motor running after it is up to speed. If a synchronous motor fails to start when it is free from all load, there is generally an open coil or a short-circuited coil, both of which will be accompanied by a buzzing noise. If there is a short-circuited coil it will become hot and burn out in a short time. If there is an open coil there will be no current in one phase and the motor will stand still, gradually becoming warm. The coils that are short-circuited or open may be replaced by a jumper. If a short circuit is caused by two coils being grounded, which is often the case, both of the coils must be disconnected and jumpers used around them.

When a synchronous motor starts in the proper manner but fails to carry the load after it is up to speed, the trouble will be found with the field circuit. The field circuit often becomes grounded or an "open" may occur. The trouble can generally be located with a test set. The field of a synchronous motor should not be opened while it is in operation, as a high voltage is induced which endangers the insulation of the field and the life of the operator.

When motors are operated with care, the operating and maintenance cost is very low compared to other sources of power. However, no matter how careful the operation is, some breakdowns may occur and often when they are least expected. Different policies are followed in making motor repairs. In some installations where the shutdown of a motor for 2 or 3 hours is very serious, as in a steel mill, a large and complete list of spare parts must be kept in stock. In other installations a few spare parts in stock are considered the most economical. The motors of a small installation when broken down are generally sent to the nearest service station for rewinding or whatever else happens to be the trouble. If an electrician is employed who is able to wind armatures and field coils, it will be found very profitable to carry a stock of magnet wire of the different sizes most commonly used and in addition a quantity of insulating varnishes and tapes. Brushes and other small parts should always be kept in stock. No matter how small or how large the installation is, an earnest effort should be made to have as few types of motors as possible in order to lessen the number of spare parts to be carried.

SOUTH AFRICAN CENTRAL STATION SELLS BOTH ELECTRIC AND COMPRESSED AIR POWER.

The mining projects in the Witwaterstrand area, South Africa, receive both electric power and compressed air from the Victoria Falls & Transvaal Power Co., Ltd., and the Rand Mines Power Supply Co., Ltd., the latter being a subsidiary of the former. The combined plant capacity of both companies, amounting to 302,000 hp. in air compressors and electric generators, substantiates their claim as the largest power undertaking in the British Empire. In 1916 the total power sold in Greater London, England, was about 40% less than the electric power sold to mining projects by these two companies. In addition, the peak load on the air service each day is about 9 tons per minute.

The following is a list of the power stations and their capacities in air and electric power: Rosherville, 64,000 hp. electric and 50,000 hp. air; Simmerpan, 56,000 hp. electric; Brakpan, 40,000 hp. electric and 10,000 hp. air; Vereeniging, 58,000 hp. electric; Robinson, 24,000 hp. electrically-driven air compressors.

WOMEN FOR METER READING IN KANSAS CITY, KAN.

The Kansas City (Kan.) Water and Light Department has decided to use women to read electric light meters. The plan has not been put into operation as yet, but more than 25 applications have been received from women desiring this kind of work. The women will have the same territory as the men have had and will receive the same remuneration for their services, $2.50 a day. No additional equipment is required for the women, but they are urged to wear simple, common-sense, business-like clothing and strictly military shoes.

Lighting of Rubber-Goods Factories

Operating Conditions in the Industry—Importance of Good Lighting and Its Advantages—Lighting Developments Meet All Requirements — Some Suggestions for Obtaining Satisfactory Lighting

By F. H. BERNHARD

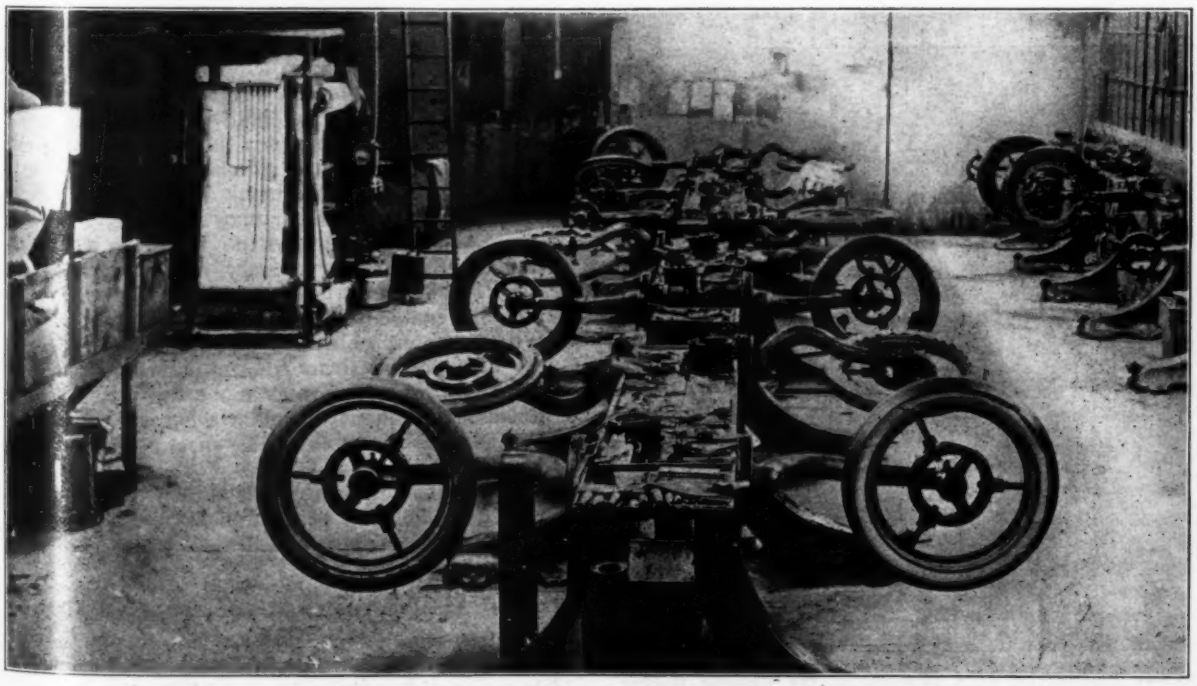
This is the ninth of a series of twelve articles on improvement in lighting in as many different industries. These articles emphasize the desirability of improving industrial lighting to meet present abnormal conditions and those to come after the war. The advantages of better lighting are presented in a non-technical way so that they may readily be brought to the attention of factory owners, managers and superintendents, most of whom have only an imperfect realization of the relation of good lighting to their industries.

Manufacture of rubber goods has made rapid strides in the 60 odd years of its existence as a distinct industry. Its first big impetus came in the Civil War through the call for considerable waterproof clothing and footwear for the soldiers. During the industrial era that followed, the production of mechanical rubber goods, such as belting, hose, packing, etc., was given much encouragement. The manufacture of tires had its modest beginnings in the early days of the bicycle and has rapidly developed since then, especially in the last twenty years during which the automobile has made such astounding progress, so that now tire production is the leading branch of the rubber industry.

The rapid development in automobile-manufacturing methods has necessitated use of more progressive methods in making of rubber tires, for these important accessories had to keep pace with perfection of design and improvement in speed and economy of production of engines, running gear, bodies, etc. Just as the general use of machinery, efficient routing of parts through the shops, scientific management in every department, and marked improvement in working conditions have facilitated and cheapened automobile production, so have similar improvements in tire manufacture had similar results.

Among working conditions one that has received an encouraging amount of study in recent years is lighting and, while there is still room for a very great deal of improvement in this particular, a fair beginning has been made in lighting betterment in a number of tire factories, or at least the subject is becoming recognized as one of considerable importance. In many tire and other rubber works one can see from the variety of lighting equipment in use and the number of lighting experiments being carried on from time to time that the lighting problem is being studied and manufacturers are attempting to find a satisfactory solution.

In some branches of the industry, where the need for night work has not been urgent, the conditions as to lighting are usually very far from satisfactory. This is true even as to daylight conditions in many cases, especially in plants with old buildings, small



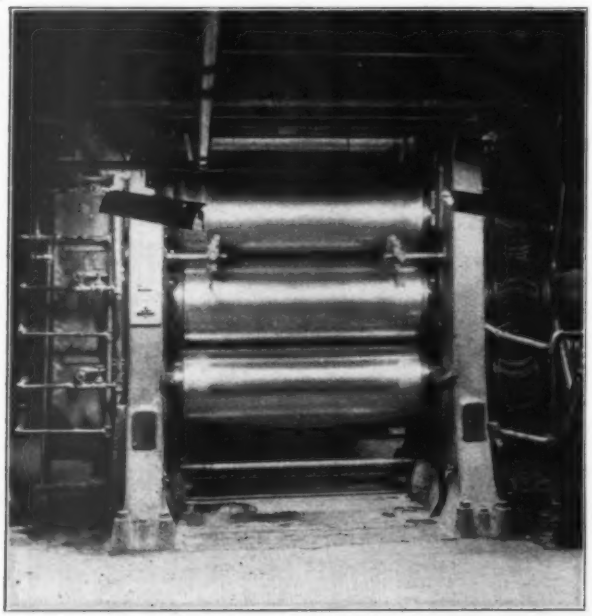
Tire Building in the Mason Tire Factory, Cleveland. Nightwork Can Be Carried on Perfectly Under Such Well Distributed and Efficient General Illumination Obtained in This Case from Mercury-Vapor Lamps—Drop Lamps No Longer Used.

and unclean windows, low ceilings, considerable shafting and other obstructions to daylight. It is in such plants also that one finds quite commonly an indiscriminate use of drop cords with low-hanging, bare and inefficient lamps to try to help overcome the deficiency of natural light by day. In most cases of this kind one word—abominable—appropriately describes both the natural and artificial lighting conditions prevailing.

Importance of Good Lighting to the Rubber Industry.

Lighting is more important to some industries than it is to others. Rubber manufacture is an industry to which it is especially important, for several reasons. Some of the properties of rubber itself constitute one reason. Its color is at first black, then usually either black, gray or red, all colors that absorb much light, which means that a high intensity of illumination is necessary to see its surface details properly. During early stages of manufacture it is a sticky substance which is likely to draw fingers into mills and other machines while feeding them where the lighting is not exceptionally good.

In this industry night work has almost come to be the rule, because the most advantageous results are obtained by continuous 24-hour operation. In fact, the heavy demands for tires and some other rubber products could not have been met promptly and economically if it had been necessary to secure additional manufacturing capacity by building plant additions. If such additions and their equipment were idle from over one-half to two-thirds of the time each day a serious loss would ensue because of the excessive investment necessary, the burdensome fixed charges on this excess investment, and the delay in getting the equipment ready for operation; moreover, the total number of employes required for one shift of 8 hours a day is actually larger than for three 8-hour shifts per day if the same output is to be produced. But this presupposes that the same general efficiency will be maintained, the same speed of production, the same quality of product, and fully as great safety by night as by day. Many rubber manufacturers are so firmly convinced of the advantages of 24-hour operation that, assuming that they will obtain practically as good general efficiency at night, they trust to luck and decide to adopt it without making any special provisions to insure this efficiency.



Effective Illumination of a Calender in the Kokomo Rubber Company's Plant. A Lamp Near Each Corner of the Machine Illuminates the Rolls Properly and Minimizes Liability of Accidents.

It should be obvious that to secure the same efficiency at night it is necessary to duplicate the conditions that obtain by day. As regards heating and ventilation of the plant, this is easily done. But as regards lighting, it is not so easy to reproduce daylight conditions, certainly not with the variety of old lighting equipment one still finds in use. And yet it can be done and economically, too, by using modern efficient lamps and accessories. Daylight illumination can be reproduced as far as practically required and in certain respects it can be improved upon, especially as to constancy of intensity and direction. Failure to provide the best possible lighting under these circumstances can mean only diminished and inferior output at night, usually accompanied by increase in accidents and greater difficulty in securing men willing to work at night. Since plants are working with as high a quality and quantity of output during the night as during day and with as good all-around efficiency, it is evident that the lighting problem is capable of entirely satisfactory solution.

If the lighting has been made good enough for efficient night work, it is of course good enough for overtime and for reinforcing the scarcity of daylight on cloudy days and the early morning and late afternoon of autumn and winter days. There are certain rubber-goods factories that seldom work by night, however, and these are the ones that have the poorest artificial lighting equipment, as a rule. But good lighting is just as important to them, if they do not want their output to suffer whenever a rainy or cloudy day appears or the days are gradually shortened as just now during fall and the approaching winter. Within a few days the shifting back of the clocks at the conclusion of the daylight-saving period will cause the loss of an hour of daylight in the afternoon, unless good artificial lighting is available or the hours of employment are shifted. As a matter of fact, no plant should subject itself to handicap by the fickleness of weather or the seasons. Good lighting costs but little and is a splendid investment in preparedness for changing seasons and weather as well as for short or long rush demands and for continued high manufacturing efficiency. In all probability these demands will be greater than ever after the war.

Before closing this part of the discussion it should be emphasized that the primary needs for lighting are:

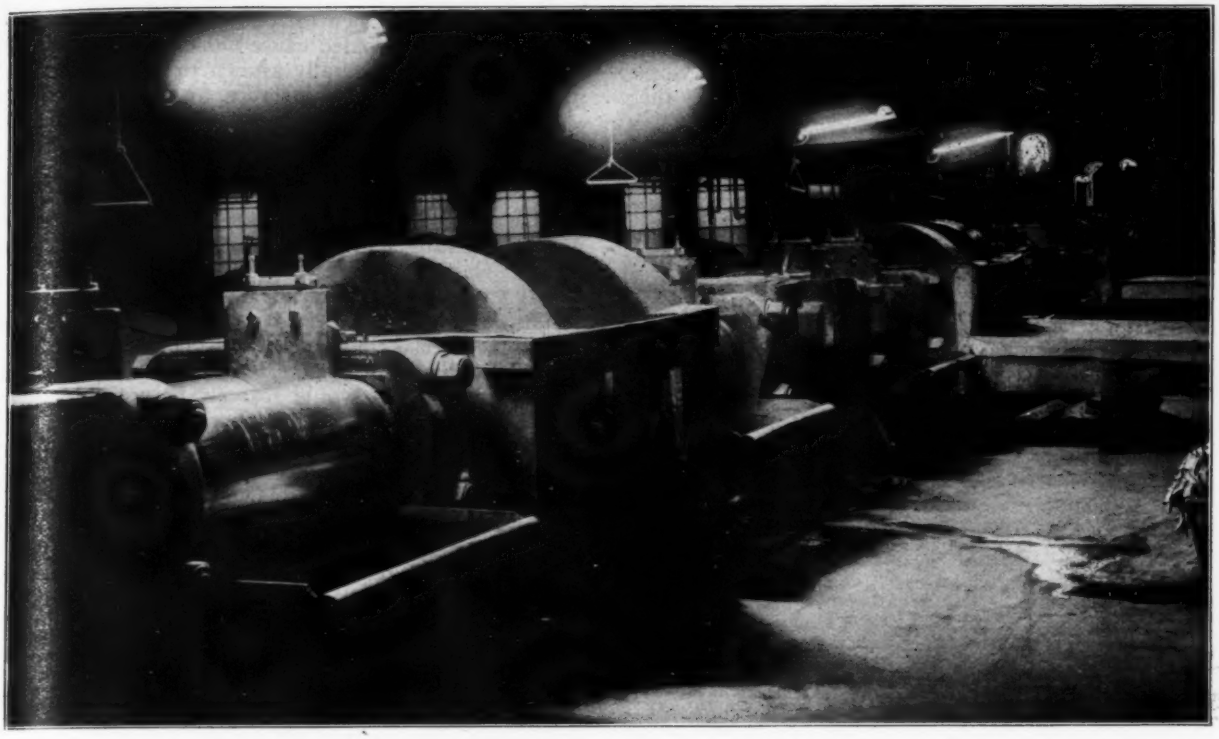
(1) To enable the workers to see without eye strain the work on which they are engaged;

(2) To permit them to see objects about the premises readily, so they may move the material and themselves walk about the plant wherever necessary without danger of stumbling or meeting with other accidents;

(3) To enable the foremen and management to see that everything is being done properly, without waste and with safety and reasonable comfort to the employes.

Principal Advantages Resulting from Good Lighting.

If a good system of lighting has been provided which accomplishes the primary objects just enumerated, there will result a number of marked advantages, the financial benefits of which quickly repay the



A Bank of Rubber Mills in Kokomo Plant. A Mercury-Vapor Lamp Over Each Mill Lights Up the Work Satisfactorily and Makes Accidents Due to Poor Lighting Unheard Of.

modest investment in such a system. These advantages, while agreeing in general with similar advantages observed in other industries, have a different order of importance in the rubber industry which here may be given in about the following order:

(1) Improved quality of product.
(2) Less material spoiled.
(3) Increased production.
(4) Reduction of accidents.
(5) Diminished eye strain.
(6) Improved orderliness and cleanliness about the premises.
(7) Supervision made easier.
(8) Workrooms and working conditions made more cheerful.
(9) Enhanced contentment of the workers.

The reputation of a firm held by the buying public depends on the quality of its product and especially on how reliably it maintains its standard of quality. In the rubber industry maintenance of quality depends to an exceptional degree on the care with which the workers carry on the different operations and on the thoroughness of the supervision exercised over the work. The cleaning of the crude rubber, the proportion of the ingredients added to it, the extent to which the mixing is done in the mills, the care in calendering, in vulcanizing or curing, and in the various finishing operations all affect the quality of the final product to a marked degree regardless of what the nature of this product may be. If the workers are handicapped by being compelled to guess at the completion of any operation instead of being aided to see it properly, it is evidently to be expected that inferior goods will not only occasionally but quite frequently be the result. Good lighting, while not an infallible means of insuring highest quality, at least is a very positive aid in overcoming the handicap just mentioned. The extent to which inferior goods frequently slip into the output is remarkable. If these are detected during or before final inspection, the firm loses only to extent of the difference in selling cost between standard quality and "seconds." But if the inspection does not separate them the firm suffers in reputation, which is an extremely difficult asset to build up.

Aside from the big losses due to "seconds" and impaired reputation, there is in most plants a heavy loss due to material actually spoiled, much of which is caused by poor lighting and consequent inability to see the work properly. This may be poor daylight due possibly to small and very dirty windows (dirt on windows may reduce their lighting efficiency as much as 50 per cent or even more), or it may be inadequate or improper artificial light due to one or more of the causes to be pointed out further on. At any rate it is an outright loss which in some poorly managed plants is covered up in one way or another. In a rubber factory taken over recently by a new and enterprising management a cleanup of the entire premises brought forth 160 tons of wasted material from obscure corners in and about the plant. Needless to say, the modern lighting system now installed will absolutely prevent similar accumulations and also greatly reduce spoilage in general.

Most discussions of industrial lighting have emphasized the increase in production resulting from lighting betterment, which in different industries and plants has amounted to anywhere from 2 to 25 per cent or even more. This is a very substantial benefit in the rubber industry no less than in others. It results primarily from elimination of the many time losses that occur when it is difficult to see the work without eye strain. Assuming that the workman is trying to do his work carefully under poor lighting conditions, the eye strain accompanying the latter compels him to slow up materially and actually to pause and look twice in many operations. If he attempts to maintain the same speed as under good day-

light or good artificial light, careless workmanship, inferior product and accidents are very likely to be the result. There are also other important time losses that a good lighting system eliminates, among these

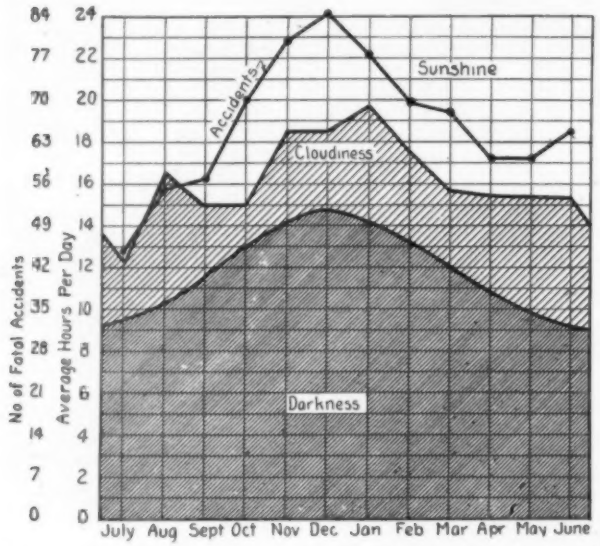


Diagram Showing How Fatal Industrial Accidents in New York During a Typical Year Were Affected by Lighting Conditions—Monthly Distribution of Accidents Compared with Average Distribution of Darkness, Cloudiness and Sunshine Per Day.

being the time wasted in looking for material when this is piled in poorly lighted stock rooms or other parts of the plant, time wasted in cautiously moving about dimly lighted passages, stairways, etc., and time wasted in outright loafing when dark corners invite a quiet siesta now and then. These various time losses aggregate a great deal taking the plant as a whole. Good lighting saves this time for useful production; moreover, it makes the employes more alert and efficient. From all these causes a very noticeable increase in production resulted in the plant referred to above.

Mixing mills and calenders are prolific sources of accidents in rubber factories. The material does not always feed itself properly between the rolls so there is the temptation to push or pull it and, being rather sticky, the operative's fingers are likely to be drawn with it and crushed. Provision is usually made for instantly stopping the machine as a safety measure, but better yet is it to prevent the accident which proper lighting helps to do. It helps reduce not only machinery accidents, but also those which occur on poorly lighted stairways, on slippery or obstructed floors, around vulcanizing outfits, etc. The relation of lighting to industrial accidents has been disclosed by R. E. Simpson, of the Travelers' Insurance Co., in several papers presented before the Illuminating Engineering Society. He made an analysis of 91,000 industrial accidents reported to his company in 1910, and found that 23.8 per cent of them were due to improper or inadequate illumination. His more recent finding is that now about 18 per cent of such accidents are due to defective lighting. This drop from 23.8 to 18 per cent represents the results of eight years of progress in the art of illumination and continued propaganda for improved industrial lighting; in other words, the accidents from poor lighting have been diminished about 24 per cent. But even on the 18 per cent basis, taking the country as a whole, the services of 108,000 men for one year are lost annually from this easily avoided cause alone.

Eye strain is generally known to be produced by inadequate lighting; for instance, an effort to read in a dim light produces it. It is not so commonly known, however, that it also results from improper lighting, such as that from wrongly placed or equipped lamps. Bare and low-hung lamps are the chief source of this trouble; these produce serious glare and this results in both eye fatigue and temporary blinding effect. As to just when glare will be produced it is not so easy to say, but in general terms it may be stated that it results when in the field of vision there are very striking contrasts in brightness, such as a bare filament or arc lamp with a relatively dark background; by day these lamps would scarcely be noticed, but at night they are extremely objectionable to the eye, which tries to guard itself by partial closing of the iris or pupil. Glare also results from the reflection of brilliant light sources in polished surfaces, such as the rolls of rubber mills or calenders.

In all cases, eye strain, whether from meager or wrong lighting, results in a marked decrease in efficiency of the worker which may take the form of diminished output, inferior work, greater liability to accident, or increased discontent. Physiologically it may produce merely temporary discomfort or headache, but when continued day after day it seriously impairs vision. Respecting it, Mr. Simpson, who was referred to above, said in his recent paper: "There is so much unintelligent use of light in the form of unshaded or improperly placed lamps that we are fast approaching the state of being a nation of eye-glass wearers. An important remedial step will be taken when we whole-heartedly get behind the movement of 'a proper reflector for every lamp.'"

Good lighting is a foe to disorderly arrangement and uncleanliness because it exposes these slovenly conditions about a plant and, by making the employes more alert, it makes them ashamed of contributing to disorder and filthiness. Thus it clears away obstructions, makes it easier to find materials, and helps to keep the plant in tidy, neat and sanitary condition, all of which has an important influence on the efficiency of the workers. It also makes supervision easier for the foremen and executives, enabling them at a glance to survey an entire room or department.

A well lighted and tidy room is a cheerful place to work in, whereas a dark and dismal room has a depressing effect on the employes. Although this influence is often unconsciously exerted, it is not the less real; it is like the depression noticed on a cloudy, rainy day. Making the work room more attractive, reducing eye strain and the liability to accidents, and otherwise improving working conditions gradually impress the employes with the human interest of the employer in the welfare of his men, from which grows not only contentment but the upbuilding of that invaluable spirit—morale. Always an asset of great importance, it is especially so in such trying times like the present. Exceptionally heavy labor turnover imposes heavy burdens in continually breaking in new hands and leaving the organization very unsettled. While good lighting makes it easier to teach and supervise new employes, it has a more important advantage in stabilizing the organization by its promotion of contentment and morale.

It is not to be inferred that good lighting, with these many advantages, is an extravagance. Its cost is indeed very low, seldom as much as one per cent of the wages of the employes, often only a half or still

smaller fraction of this. This cost includes fixed charges on investment in lighting circuits, lamps and fixtures, operating cost, depreciation and maintenance. In view of this low cost, almost any of the benefits of good lighting pays for it. For instance, an increase in production of only a few per cent brings handsome returns for the lighting investment; again, reduction of accidents may alone quickly offset the lighting cost. Poor lighting is therefore entirely inexcusable, so much so in fact that the authorities in the states of Wisconsin, Pennsylvania and New Jersey have drawn up factory lighting codes in which industrial lighting betterment is insisted on on the score of safety and protection of vision of the workmen. Other states are drafting similar codes.

Lighting Development Meets All Rubber-Factory Requirements.

Up to some dozen years ago good factory lighting was almost never heard of nor even thought of, because the lighting art was still in relative infancy as to knowledge of the requirements of good lighting and as to the development of efficient and generally adaptable lamps. Since that time almost astounding progress has been made, both in scientific investigation of lighting requirements and in the invention and perfection of very efficient incandescent lamps ranging in size from 6 to 1430 spherical candlepower. This wide range in tungsten-filament lamps permits selection of a lamp to suit any required power. The lamps over 100 cp. are a development of the last five years. For many purposes in industrial plants there are also available the mercury-vapor lamps which continue to give a good account of themselves. Arc lamps and all other incandescents are rapidly being superseded by these newer and much more efficient lamps; the old and widely used carbon incandescent lamp has finally been tabooed as a fuel-conservation measure because of its gross relative inefficiency.

While lamps have been perfected in the last dozen years, important developments in reflectors also took place. Durable and efficient types have been brought out. Steel reflectors with either aluminized or porcelain enameled reflecting surface are the most rugged type now made. Within the present year a new standardized line of dome-shaped enameled-steel reflectors has been developed. Glass reflectors are also quite widely used where they can be mounted high so as to be protected from hard knocks; these glass reflectors are either of mirrored, prismatic or opal glass. Besides open reflectors there are available completely inclosing diffusing glass globes of different shapes, sizes and types, besides special fixtures combining both upper reflectors and diffusing bowls, cups or bands.

Some Suggestions for Obtaining Satisfactory Lighting.

The lighting problem in certain parts of rubber factories requires very special study, whereas in most rooms the same general principles found so successful in other industrial plants can be applied, but this must always be done with judgment to prevent disappointment. Wherever possible, and especially in large plants and those operating 24 hours a day, it is advisable to consult a lighting specialist and have him design and supervise installation of the lighting system; in this way the most satisfactory results will be obtained without much experimentation and numerous trial installations.

Rubber mills are in a class of machinery that must be lighted with special care. The top of the mill with the opening between the parallel rolls must be especially well lighted to prevent the accidents already referred to. This requires not only high-intensity but glare-free illumination. The polished rolls are like mirrors and produce dazzling glare if a bare lamp is placed over or near them. This can be readily avoided, however, by using a bowl-frosted lamp in a good reflector, a diffusing cap with the reflector, a reflecting cap and upper reflector combined in a special fixture, or a completely inclosing globe. The latter is quite effective, but not so efficient as the reflector combinations mentioned. A single lamp, properly equipped with reflector and diffusing means, and placed high over the center of each mill will give good lighting on the mill and around it.

Another difficult problem is the lighting of calenders. Here again protection against accidents requires glare-free lighting, but a single lamp over the top of the machine is obviously not satisfactory. The faces of the rolls, especially the two lower ones, and the space around the machine must be well lighted so that the boys or other operatives will not cast a shadow on the rolls or the working area in front of them or the gears, etc., at the sides. Probably the best method of lighting is by means of four lamps placed near the corners of the machine and each properly equipped with reflector and diffusing means.

In preparing rubber cement or in other places where inflammable volatile vapors are used, it is necessary to employ special vaporproof fixtures to guard against fire. These fixtures should be hung high or else, if this is impossible, they should be provided with reflectors that direct the light usefully and protect the eyes from glare.

In other parts of the plant general lighting, obtained very efficiently by fairly large units properly equipped with reflectors and mounted high to give as uniform illumination as possible, will be found very much better than the old common practice of using localized lighting with an individual drop cord for almost each employe. This obsolete system is inefficient, gives uneven and usually glaring illumination, and is very troublesome to maintain properly. Fuel conservation, as well as eyesight conservation and improvement in the general efficiency of employes, all demand that it be superseded by modern and efficient general lighting, which gives very much better satisfaction all around and often also lower lighting cost.

Making Fire Hose. Excellent General Illumination Furnished by Mazda Lamps Properly Equipped with Reflectors.

Pulverized-Coal Tests Conducted at Milwaukee—II.

Gross Efficiency of 85. 22 per cent Obtained—Description and Results of Tests—Constant Nature of High Efficiency Obtained Justifies Use of Pulverized Coal as Fuel

In our last issue, the air supply and other preliminary tests which were made by the Milwaukee Electric Railway & Light Co. at its Oneida street station to determine the advisability of utilizing pulverized coal in its plants were described. The first boiler used in the test was unsatisfactory due to insufficient air and a new one was built in which the following tests were carried out. On Aug. 12 and 13 the final efficiency tests were made using an Edge Moor boiler equipped with "Lopulco" type coal feeders and burners. Because of the nature of the equipment, the coal used in these tests could not be weighed on the firing floor but had to be weighed at the moist coal bunker. All analyses were made at the laboratories of the Milwaukee Electric Railway & Light Co.

The feed water used during the test was weighed on two standard tank scales at 2000 lb. capacity each. All feed pump gland leakage was accounted for in the way usually adopted on standard boiler tests.

All temperatures and pressures were taken with instruments, which, previous to the test, had been checked against standard instruments. The blowoff piping on the boiler was disconnected so as to insure against any possible loss of water. Flues were blown 5 times during the 24 hours.

Flue-gas analyses were determined by means of an Orsat apparatus.

Throughout the test, very uniform conditions were maintained. The speed of coal feeders and the drafts carried were held constant. The feed-pump speed had to vary somewhat from time to time. The variation in the rate of evaporation was, however, due to slight changes in the quality of coal during the test run.

Pulverized Fuel vs. Mechanical Stokers.

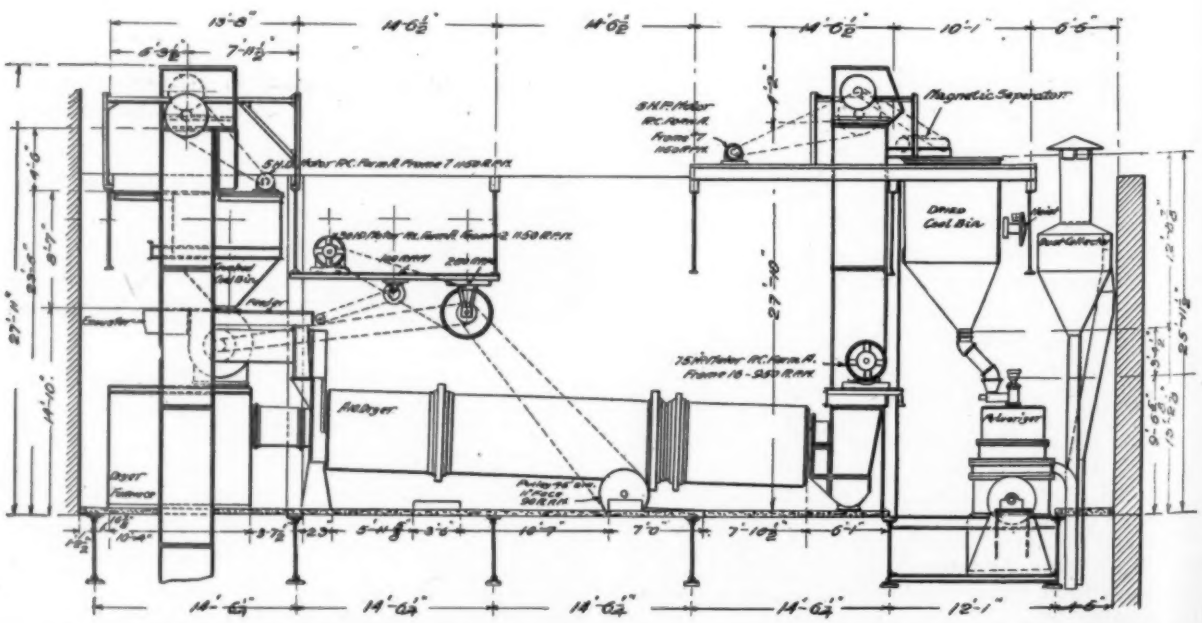
1. Under this heading, let us first consider fuel preparation costs. In the case of powdered coal this can be classed under three general divisions:

(a) The cost of crushing the coal. This expense is the same for either the pulverized-fuel or mechanical-stoker equipment.

(b) The cost of drying and pulverizing the coal. Although no cost records are available at present, it is estimated that 32 cts. per ton will cover this preparation cost on a 200-ton-per-24-hour plant using bituminous coal containing about 12% moisture.

(c) The maintenance costs of the drying and pulverizing plant. This unit has not been determined from actual experience. However, it is estimated that 3 cts. per ton will cover the maintenance. In stoker practice, the maintenance cost per ton of fuel fired is close to 5 cts. per ton.

Summarizing the above facts, it is evident that with fuel at $5 per ton, the gross efficiency shown by the pulverized fuel boilers will have to exceed that shown by the mechanical stoker fired boilers by 6% in order to offset coal preparation costs. A 6% deduction from a gross efficiency of 85.22% results in a net efficiency of 79.22% for the powdered-coal burner. In stoker practice, the maximum attainable gross efficiency at any of our plants has been 80.54%. Deducting 2.5% for auxiliary uses, the resulting net efficiency



Elevation Showing the General Arrangement of Pulverized-Coal Equipment at the Oneida Street Station in Milwaukee.

is 78.04%, which is lower by 1.18% than the figure obtained in pulverized-fuel practice.

Other advantages resulting from the use of pulverized fuel are summarized herewith:

2. Continuous boiler operation at a uniform rating as well as a constant efficiency is made possible. At no time is there a loss in capacity due to the clinkering of coal on the grates or the cleaning of fires.

3. Heavy overloads can be taken on or dropped off in a very brief time through the adjustment of the coal feeders and the furnace drafts.

4. From 97 to 98% of the combustible in the coal is utilized, regardless of the quality of the fuel.

5. The ash-handling costs are reduced to a minimum, due to the reduced volume.

6. The banking conditions when operating with pulverized fuel are somewhat different than those obtained in stoker practice. By stopping the fuel supply and closing up all dampers and auxiliary air inlets a boiler can be held up to pressure for about 10 hours. The furnace brick work having been heated to incandescence during operation, gives off a radiant heat which is absorbed by the boiler rather than being sent out through the stack.

The ease of controlling the fuel, feed and drafts, the ability to take on heavy overloads in a brief time, the thorough combustion of the coal, and the uniform efficiency obtainable under normal operation, makes pulverized coal a most satisfactory form of fuel for central-station uses.

The full story of maintenance is only partly known to us as yet. Indications are that no unusual difficulties will be met. The cost of coal preparation and labor for operating a boiler room fully equipped with pulverized coal burning boilers will be a question for the engineer to decide for himself, according to his particular conditions.

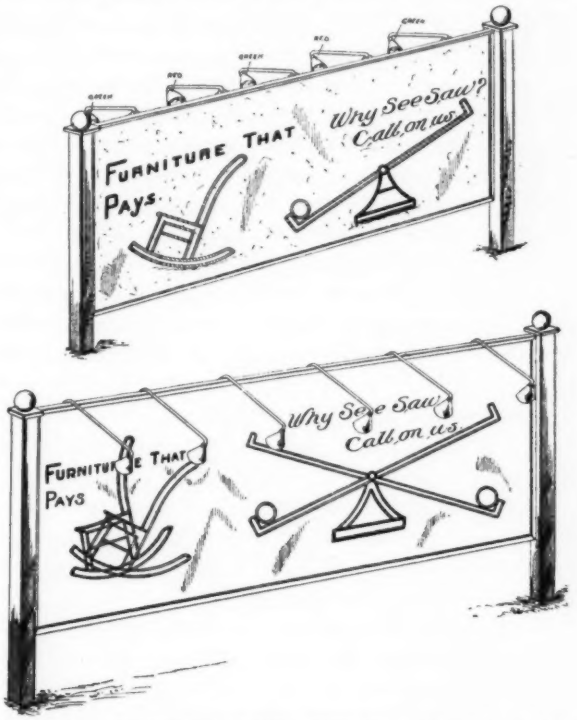
Properly installed with respect to capacity of storage, size of dryer and pulverizers, and on a sufficient number of boilers to properly and fully employ the minimum number of men, the pulverized fuel installation will most undoubtedly be more advantageous. The main item that must be borne in mind by the engineers is that the ease with which a high efficiency is obtained and the constant nature of that efficiency as compared to the lack of constancy of efficiency in a stoker-fired boiler, unless very closely supervised, is the one factor about the burning of pulverized fuel which justifies its use. There is no doubt that with a well equipped plant burning pulverized fuel, having all the necessary recording and indicating instruments to guide the operators in maintaining the proper conditions, a lower cost of generating steam will be possible than has heretofore been the case in any style of equipment.

The foregoing data were presented by John Anderson, chief engineer of power plants of the Milwaukee Electric Railway & Light Co., before the traveling engineers at their convention held under the auspices of the United States Fuel Administration at the Fort Dearborn Hotel, Chicago, Ill., on Sept. 9, 1918.

A SEEMINGLY ANIMATED SIGN.

Those who heard M. Luckiesh some years ago when he was demonstrating the effect on paintings of variously colored illumination will recall how the absorption of light rays by complementary colors in the paintings altered the appearance of the pictures to a marked degree.

The same principle, namely, that of practically obliterating a given color by using an illuminant of a complementary color, is employed by Richard M. Craig, of San Antonio, Tex., in the advertising sign described in United States Patent No. 1,276,494. According to this patent, Mr. Craig paints the subject matter of his sign in two positions, one position being shown in red and the other in green. Then he arranges both red and green lights for illuminating the sign and alternately switches the current from one group



Sign Made Animated by Lighting With Complementary Colors.

of lamps to the other by means of a motor-driven switch.

For example, if he wants to present seemingly animated pictures of a rocking chair and a see-saw, as shown in the upper of our illustrations, he paints these articles in red in the position thus pictured and paints them in green in their other extreme positions. The effect in daylight will be that shown in our second illustration, but when illuminated alternately by red and green lamps, only one position is clearly visible in each case. Consequently, the result is an apparent representation of movement in a sign entirely devoid of moving parts.

NEWARK ELECTRICAL INTERESTS GIVE LIBERTY LOAN ENTHUSIASTIC SUPPORT.

Electrical interests at Newark, N. J., and vicinity have given enthusiastic support to the Fourth Liberty Loan. Among the prominent subscriptions are Westinghouse Electric & Manufacturing Co., $90,000; Driver-Harris Wire Co., $25,000; employes of the Public Service Corporation, $23,850; electrical, power house and allied departments of the Raritan Copper Works, Perth Amboy, about $26,000; employes of the Miniature Electric Lamp Corporation, Newark, $6050; the New Jersey Power & Light Co., Dover, reports that subscriptions aggregating 94 per cent of total employes have been received, while the Electric Heating Apparatus Co., Newark, has attained 100 per cent.

Editorial Comment

Increasing Time Diversity in Service

FRUITLESS efforts have been made in Washington within the last few weeks to extend throughout the oncoming winter the action of the daylight-saving law. These recent efforts were made primarily to secure a better diversity in demand on certain central stations supplying large industrial centers where shipbuilding and manufacture of war munitions is creating enormous demands for power. In the summer these demands have been met quite satisfactorily, but with the shortening days the lighting load is gradually creeping on top of the normal and the emergency power loads, so that the prospects in some cities, like Philadelphia, were that a power shortage might develop during the winter that might seriously impede, if not cripple, the essential industries.

As early as last January, before the enactment of the daylight-saving law, a number of prominent central-station men led by Mr. Samuel Insull, of Chicago, strongly advocated making the change of the hour effective throughout the year instead of the summer months only, so as to relieve the power companies of the heavy afternoon peak during the winter months. The improved diversity-factor and load-factor obtained, it was pointed out, would materially improve power conditions during the coming winter and minimize the possibility of the recurrence of power shortages such as those experienced last winter in several cities. Mr. Insull showed that the spreading out of the peak would not only relieve the power companies by giving them a better load-factor, but also would make available for the country's needs considerable power-generating equipment that now must be held in reserve for the heavy peak demands during the winter months. The result of these early efforts was to extend the operation of the law from the five months originally proposed to seven months, but the matter of continuing throughout the winter was practically dropped until the prospects for unusually heavy winter demands in a number of cities developed.

Since it has been decided to stick strictly to the law and to change back the clocks on October 27, we shall not have the benefit of this improved load-factor just at the very time when the country needs it so much. The sudden loss of one hour of daylight in the afternoon will be felt keenly by the entire country, and although it will be compensated to some extent by an additional hour of daylight in the early morning, the change we feel quite sure will cause considerable commotion. Many who have enjoyed the extension of daylight in the afternoon will no doubt be reluctant to give it up. In this lies one hope that the lighting peak will not be quite so heavy as it usually has been in the late fall months. Another comes from the fact that there has been considerable curtailment of display and some other lines of lighting. A more important one lies in the fact that the present epidemic of influenza has caused the health authorities in a number of the big cities to not only close nearly all public meetings and gatherings but even to advocate that congestion in street cars and other means of public conveyance be minimized as far as possible. In Chicago, for instance, the commissioner of health is trying to bring about the spreading out of the hours of employment so that instead of the great mass of employes being turned out of stores, shops and offices at 5:30 p.m., they will leave at various intervals beginning, say, at 4:30 and continuing until nearly 6:30. The relief from the violent and insanitary traffic congestion which now prevails will thereby be marked.

Over three and one-half years ago this journal strongly advocated through its editorial columns this plan of spreading out the time of beginning and quitting work so as to relieve our city traction systems of the enormous burden of trying to carry practically all employes to or from their places of employment in a space of about an hour. It was then pointed out that not only would the traffic congestion be relieved and riding made more comfortable, but the companies would be relieved from keeping on hand a mass of rolling stock which is used for little over two hours a day. Many overtaxed terminal facilities would also be relieved and in connection with power supply a very substantial spreading out of the transportation load would result. It is, therefore, earnestly to be hoped that these measures, now taken up under the stress of emergency, will be seriously considered by the community and, when the merits of the plan are realized after a fair trial, that they will be made permanent.

Trolley Systems for Freight Haulage

THE gas truck is receiving continued attention and application for the movement of freight along our highways. Ambitious programs are in process of promulgation for improved highways for placing truck fleets for inter-city transportation upon a vast scale.

The automobile has proved very effective for relieving railroad and depot congestion and hastening freight movement, partly because it came into use when most needed and thus solved a vital problem and partly because more flexible than the railroad. The

gas truck is well able to move small consignments of freight short distances and changing locations which are unfavorable conditions for the heavier mode of transportation. However, the gas truck with its many high-speed parts, its complicated mechanisms, its expensive tires and ever-present vibration is operating under a very real handicap because of the necessity for continual watchfulness and care of upkeep, the skilled labor required for maintenance, and the high cost and rapid deterioration. There is also the matter of deterioration of roads, a matter that has already made itself so prominently objectionable that Government cognizance has had to be taken.

Because the gas truck found a ready means of alleviating overburdened railroads, it found wide adoption and universal approval. But there is another solution for at least part of the problem of accelerated transportation of freight. That solution is the electric railroad. So far, notwithstanding the vital and pressing needs of the nation for conserving men, materials and time, little has been done in the way of placing our vast network of trolley systems upon a war basis—hauling of inanimate as well as human freight. The gas truck can go where the electric railroad with its trolley and track does not go. But there are many truck routes operating in parallel with existing trolley lines, where, if competition were present, the former could not exist. Unfortunately, competition is lacking.

The most economical way of handling freight, reducing congestion and speeding up results is that way which will bring about the greatest good. And a system to be permanent must be sound. The rapid deterioration of the gas truck, the havoc wrought by these trucks upon the nation's roads and the high cost of maintaining both of these are matters that make one wonder whether the gas truck is a permanent thing or not. Only those that have seen the havoc wrought by the fleets of trucks now traveling our highways can appreciate the short life of the roads and the cost of this mode of transportation. This cost of highways has to be met, but by whom, the consignee of the freight, by local or national taxation, or how?

The electric railroads of the country offer a very real and really urgent opportunity for freight haulage in a way that will assist the railroads and save the highways. Just as the gas truck has its scope, so too has the electric railroad. We do not believe, where either trolley or truck answer the purpose, that the truck can compete with the trolley; and there are other incentives for using the trolley and tracks instead of the roads wherever feasible. We are anxious to see the trolley companies get into the game of handling merchandise and freight, for it is a profitable business and one that will bring much benefit to the community and to themselves.

The electric railroad is a potential factor in relieving railroad congestion, accelerating freight movement, bringing the producer nearer the consumer, reducing the high cost of living, and conserving the nation's highways. At present the gas truck is finding the wide and large use it is because those able to encourage, operate and sponsor the trolley for freight haulage are not behind the matter with the push and determination that it requires, that it deserves and that it must have if the trolley for freight haulage is to come into its own.

We are fighting for a permanent peace. We are looking for improved conditions when the war is won, because the efficiency necessary for winning a war may be expected to remain to a very large extent. We cannot believe, therefore, that the present simply and quickly applied mode of alleviating congested railroads and hastening transportation by trucks upon highways is more than a transitory method, a convenience of the moment. Neither as regards time or cost can the motor truck compete with the trolley where the two cover the same ground and each is operated at its highest efficiency.

Saving Coal in the Boiler Room

WITH painstaking effort, endured research and experimentation, the steam turbine has been improved until little remains in the way of improving economy without increasing the working range of the steam by going to higher temperatures and pressures, since the lower range is fixed. And when the pressure and superheat of the steam is increased and numerous difficulties and uncertainties in turbine design and performance are overcome, the gain in economy is not epochal.

On the other hand, and in marked contrast, by putting the average power plant in order, eliminating carelessness, ignorance and uncertainty in the many places where they may so often be found, and adopting modern methods, economies can be brought about that will very often reduce the fuel consumption 20 per cent and more. And, it should be noted, this is accomplished without material expenditure of money, but chiefly an expenditure of effort. Moreover, it might be further emphasized that whereas higher pressures and superheat of steam are feasible only for the larger stations, improved boiler-room methods and operation know no such restrictions, but can be applied in the small as well as large plant.

A boiler room can usually be improved and economy brought about so easily, so quickly and with such certainty as compared with the gradual and painstaking development and evolution through which the turbine must pass to make it reliable, certain and safe for the proposed increased working range of steam. Accomplishment of the one follows a general and well-worn path; the other is a specialized undertaking, bristling with difficulties and uncertainties. Yet the one that can be performed almost universally offers wider application than the other with its restrictions, and it may be done now with economies comparable with those brought about by the latter. And now is the time to save coal.

Week's Events

Additional Horsepower to be Developed by Niagara Power Merger — Manufacturers Discuss Substitutes for Brass

NIAGARA POWER MERGER EXPECTED TO INCREASE EFFICIENCY.

100,000 Additional Horsepower to Be Developed for War Work.

At the request of the Government, the New York State Public Service Commission recently approved the application of the Hydraulic Power Co. and the Niagara Falls Power Co. to merge these two companies into a $62,000,000 corporation. By changing the present diversion of the water from two channels into one and thus securing greater concentrated efficiency, it is hoped to add 100,000 hp. to the present capacity of the plants without diverting any additional water from the Falls. This was decided upon after considerable investigation, carried out under the direction of Col. J. G. Warren of the Engineer Corps, as the quickest and most suitable method of securing the additional power needed for war work in this vicinity.

This will be accomplished by diverting the entire flow for both companies, 19,500 cu. ft. per second, into the new channel of the Hydraulic Power Co. It will, however, require the construction of about one mile of canal or tunnel raceway to complete the combination. This work will be started at once. It is expected that 30,000 hp. will be ready for delivery 12 months from the starting date and 30,000 hp. additional every three months thereafter until the development is completed.

This plan secures the full efficiency of 20 hp. per cu. ft. per second from the pool above the Falls to the pool below the Falls. Although the full efficiency from the Falls to Lewiston is 29 hp. per cu. ft. per second, to obtain this efficiency would entail about five times the expense and labor and considerably more time than the present plan does. Furthermore, the present plan will fit in with any later scheme which will utilize the power to its maximum efficiency.

PROGRESS OF C., M. & ST. P. ELECTRIFICATION IN WASHINGTON.

Substations and Lines Completed and Locomotives Ordered—Expect to Operate by July 1, 1919.

In noting the progress of the electrification work on the Chicago, Milwaukee & St. Paul Railway from Othello, Wash., to Seattle and Tacoma, it may be stated that the 8 substation buildings are practically completed, and the work of installing transformers and other electrical equipment at those substations is well under way.

The General Electric Co. is equipping 5 and Westinghouse Electric & Manufacturing Co. is equipping 3 of those substations. Of the 15 electric locomotives ordered for the new electrified line, 10 are being built by the Westinghouse company and 5 by the General Electric.

The pole line covering this route of over 200 miles has been completed and the stringing of the trolley line will be accomplished, to be ready in time for the completion of the other work.

In the main, electric power for operating this line is to be supplied by the Washington Water Power Co., Spokane, whose power lines are being extended to Othello; but the system will be tied in with the Stone & Webster power system by the extension of a 100,000-volt line from the latter's generating station at Snoqualmie Falls, Wash., to constitute a standby or reserve power.

It is generally understood in Seattle that electric locomotives will be hauling passenger and freight trains over the Othello-Seattle-Tacoma division by July 1, 1919.

JOVIANS PROVE THEIR PATRIOTISM IN BOND BUYING.

New York League at Recent Convention Oversubscribes for Plus Bonds.

The New York Jovian League held the first meeting of the season on Oct. 16. The proceedings were opened by a luncheon at the Hotel McAlpin, after which addresses were made by Charles Pope Caldwell, member of the Committee on Military Matters at Washington; Lieut. John Quinney, of the Canadian Army, who fought at Vimy Ridge and Messines. Theodore Beran, chairman of the Electrical Division of the Liberty Loan Committee, and T. C. Martin, chairman of the Electrical Societies Division, also spoke briefly upon the Liberty Loan. J. M. Wakeman, president of the League, who presided at the meeting, called for subscriptions to the loan. Although everyone present had already subscribed through various other channels, the 150 men present responded with subscriptions for $35,000, and James H. McGraw promptly matched the amount already raised, making a total subscription of $70,000 to the loan. The next largest subscriber was Harry B. Logan.

A number of men prominent in the industry were present, and Thomas A. Edison sent in a $500 subscription by mail. Major Cleveland M. Hall, of the Canadian service, and George B. Muldaur, Jr., of the Rainbow Division, one of the heroes of Chateau Thierry, were among the military men at the head table.

HEATING THE HOME ELECTRICALLY.

W. F. Pease Equips Home with Installation as Experiment —Wide Variation in Temperature Possible.

To further assist the Government in the conservation of fuel, W. F. Pease, manager of the Lowell Light & Power Co., of Lowell, Wis., has worked out a plan for heating buildings electrically. Mr. Pease has installed a system in his new home whereby he expects to heat it to the same temperature as with coal, and with less money and have the system entirely automatic. From all present appearances it

will prove successful both to the central station and its consumers.

Mr. Pease will not as yet furnish information in regard to the electrical equipment further than saying that its maximum capacity is 10,000 watts, which can be enlarged at any time and that it is controlled automatically by a syphon regulator which will allow six different heats to be obtained. In his present system he has the electrical equipment connected direct to the hot-water system of heating having a radiating surface of 545 sq. ft. Complete data are being kept of this outfit and its operation and further information will be furnished some time in the near future.

This system can be applied to any present steam or hot-water system that is installed for a price in the neighborhood of $50 covering material for a unit having a capacity of 10,000 watts. It will operate on either 110 or 220 volts.

Mr. Pease advises that he is not thinking of placing this on the market for sale as yet, but has installed this as an experiment.

AIR SERVICE IN NEED OF SKILLED MECHANICS.

Misunderstanding of Status of Draft Men Causes Volunteer Enlistments to Fall Off.

In an endeavor to keep on hand a constant available supply of men for the air service of the army, a reserve list is being drawn up from which these men may be taken as needed. A large number of skilled mechanics from almost every trade, who can pass the rigid physical examination, is required. These men are absolutely essential if we are to keep up our air program.

In order to aid as far as possible in supplying these men, the War Department has recently increased the age limit for men in this service from 46 to 56 years. Previous to this extension of the age limit, many otherwise acceptable men were rejected, and it is hoped that these men will now re-apply for enlistment. Another difficulty which has been experienced in enlisting applicants is due to the prevalent misunderstanding that draft men cannot volunteer. The War Department has ruled that all men of draft age, not in class A-1, may be inducted into the Air Service.

Nearly all branches of labor are needed from engineers and photographers to tailors and cobblers. Although the minimum pay is the same as is received in the regular army, i. e., $30 per month, the majority in this service receive more, many as high as $121.50 per month.

Applications for this service may be filed at the office of the Air Service Officer, Room 902, 104 Broad street, New York City. Any further information desired can also be obtained here.

WAR NEEDS BRING ABOUT CHANGES IN ENGINEERING.

Changing to Other Lines of Work Tends to Broaden Individual Scopes.

"In my opinion, the entire engineering profession is undergoing a change which will result in great gains for the nation," is the recent comment of A. H. Krom, director of engineering, at the office of the Division of Engineering, 29 South La Salle street, Chicago. Mr. Krom is registering the technical men of the nation and placing them according to governmental needs and is therefore in a position to know about any such changes. The recent addition of women in many of the minor technical positions as well as the great demand for technical men is responsible for this change. Up to the present, engineers, as a class, have been governed largely by tradition. Whatever branch of engineering a man started at he kept at, seldom paying much attention to the other branches of the profession.

This, however, is no longer the case. Technical men are changing from one line of work to another, studying related branches of their profession and striving to establish new standards. Many good technical men who formerly held semi-technical positions are now engaged in real technical work in the factories doing war work, and their places have been taken by women. This should tend to broaden the knowledge of these engineers which will certainly result in a great gain to the profession.

ENGINEERING FOUNDATION GIVEN NEW $100,000 ENDOWMENT.

Ambrose Swasey of Cleveland Brings His Total Gifts to Total of $300,000.

At a joint meeting of the trustees of the United Engineering Society and the Engineering Foundation Board held Oct. 7, in New York City, an additional gift to the Engineering Foundation of $100,000 by Ambrose Swasey, of Cleveland, Ohio, was announced. It will be remembered that it was Mr. Swasey's original gift of $200,000 in 1915 that made the establishment of the Engineering Foundation, representing nearly every branch of engineering, possible.

Mr. Swasey, who is past president of the American Society of Mechanical Engineers, presents this latest gift as an expression of appreciation of the many services rendered to the Government and engineering research by the foundation. Although this gift is opportune and very generous, further endowments are needed by the foundation if it is to carry the large work which it has undertaken to success.

GALENA CENTRAL STATION HAS ATTRACTIVE WINDOW DISPLAY.

The Interstate Light & Power Co. (subsidiary of Northern States Power Co.) at Galena, Ill., has a window display which is attracting considerable attention. It consists of a large map of the war zone, bordered by an American flag and flags of the Allies, on which is printed in a red-and-white line the position held by the opposing armies on Aug. 1. The present line is indicated by a row of red-headed tacks along which a red string is run. Back of this line is the line of Oct. 1, indicated by white-headed tacks and a white string. The red line is changed every morning. The display is well illuminated at night and attracts a considerable crowd at all times.

WISCONSIN TRACTION COMPANY REQUESTS PERMISSION TO INCREASE FARES.

The Eastern Wisconsin Electric Co. has applied to the Railroad Commission of Wisconsin for permission to increase the city fares at Sheboygan, Fond du Lac and Oshkosh from 5 to 6 cents. The hearing was to have been held at Madison on Oct. 17, but was postponed because of the illness of the city attorney.

MEETING CONSIDERS SUBSTITUTION OF DIFFERENT METALS FOR BRASS.

Reduced Output of Mills Due to Influenza and Other Causes Requires Steel and Other Metals to Replace Brass.

At the call of A. W. Berresford, a meeting of manufacturers of electrical supplies was held at the offices of the Associated Manufacturers of Electrical Supplies, on Oct. 19, representatives of some 25 manufacturers being present. Mr. Berresford explained the situation in connection with brass production, also his conference with Everett Morse, chief of the Brass Section of the War Industries Board and a member of the Priorities Division.

Owing to the influenza epidemic and other reasons, production by the mills has been reduced to less than a 50-per cent basis. Mr. Morse had stated that unless the manufacturers took up the substitution of steel and other metals, it would be necessary for him to issue definite instructions that orders could be filled only if accompanied by a permit stating the general purpose for which the material was wanted. In short, his statement through Mr. Berresford to the manufacturers had been: "Will the manufacturers play with me in an effort to accomplish the necessary results?" Otherwise, drastic measures will have to be used.

An extended discussion followed. J. H. Trumbull stated he had recently had an interview with Mr. Morse, and that Mr. Berresford had in no measure overstated the case. He suggested that each manufacturer report at an early date what percentage of brass he could save by substitution.

Mr. Berresford suggested that each and every group should meet at once and discuss eliminations and substitutions and be prepared to make a report the coming week.

In response to a suggestion at this meeting a call was issued Oct. 19 for the Wiring Devices Section, embracing 77 manufacturers, to attend a meeting at the offices of the Association on Oct. 23. Other groups took similar action, and upon further discussion the following were decided upon as subjects to be considered, upon which definite statements should be made:

Average monthly consumption of past six months; percentage reduction possible; time necessary to effect; character of substitute and amount required—copper, steel, zinc, etc.; wherever possible, indicate uses which may be specified for prohibition.

Mr. Trumbull suggested, in order to facilitate the work, that reports should be made on a tonnage basis, including average per month, stock in hand and complete list of eliminations of brass by substitution of other metals.

INFLUENZA EPIDEMIC CAUSES POSTPONEMENT OF MANY MEETINGS.

Meetings of Electrical and Engineering Associations Postponed Indefinitely on Account of Epidemic.

On account of the widespread and serious character of the Spanish influenza epidemic now prevailing, every precautionary measure is being taken to prevent the further spread of this disease, and among these is the closing of theaters and similar public meeting places until further orders.

Many meetings of electrical and engineering societies which had been scheduled have been postponed indefinitely, among which are: Electrical Supply Jobbers' Association and the Electric Power Club, at Cleveland, Ohio; the Empire State Gas and Electric Association, New York City; American Society of Mechanical Engineers, Indianapolis, Ind.; American Institute of Electrical Engineers, Philadelphia, Pa.; Western Society of Engineers, Chicago, Ill.

ELECTRICAL GAS PURIFICATION.

An interesting summary of various processes for removing suspended particles from gases by electricity is given in the French "Revue Générale de l'Electricité." A method recently devolped in France by Messrs. Lailler and Gallot makes use of a series of tubes, the increased potential drop at the end of which is counteracted by varying the diameter. The efficiency of precipitation is stated to be directly proportional to the length of the tube and inversely proportional to the speed of the flow of gas. In the apparatus described two different methods are used. In one case a vertical tube with a fine wire down its axis is used; in the other case the dust-laden gas is introduced into a horizontal tube with a negatively charged wire stretched down its center. This has the advantage that the deposited material falls into hoppers in the lower wall of the tube and does not accumulate round either of the electrodes or the insulators to which the wire is attached and which are located outside the tube. The process is being taken up by the Société de Purification Industrielle des Gaz.

WAR-TIME LIGHTING RESTRICTIONS IN ENGLISH MOVIE THEATERS.

By order of the British Coal Controller, the lighting and heating of cinema theaters is to be strictly rationed. Performances that are not well attended will be regarded as unjustified and needing curtailment, and the number of hours of opening per day will be reduced. Since last March, heat, light and power consumption have been reduced by closing at 10:30 p. m. The Cinematograph Exhibitors' Association, in co-operation with the Coal Controller, will by local regulation cut down the lighting of theaters to the utmost limit.

STANDARDIZATION OF PLUGS AND RECEPTACLES PROCEEDING.

Work is well under way by the Heating Devices Section and its committees of the Associated Manufacturers of Electrical Supply upon the standardization of plugs and receptacles on appliances. Government war regulations have brought about the elimination of a great many unnecessary designs and the work of the Section has been much simplified for this reason. It is probable that many of the restricted designs will never be brought out again after the war.

TO WELD SHIPS BY ELECTRICITY TO SAVE TIME.

Substitution of electric welding for the riveting system in shipbuilding, with a consequent saving of three-fourths in time and labor costs, is being considered by the Emergency Fleet Corporation. Orders have been issued, it is understood, for the construction by electric welding of a 42-ft. midships section of a 9600-ton ship at the yards of the Federal Shipbuilding Co., at Kearney, N. J.

Commercial

Disadvantages of Step-Rate Meter System — Patriotic Window Display—Electric Heating in Telephone Industry

UNSATISFACTORY RESULTS OF STEP-RATE METER METHOD SHOWN.

Block System, Which Can Easily Be Substituted, Proven Much Better.

An important step towards the standardization of methods of charging for electric service in New York state was taken when the Empire State Gas and Electric Association at a recent meeting adopted a resolution disapproving the use of the so-called "step meter" rate. This and other resolutions recently adopted by the association the principal one being the approval of the service-charge rate, should, with the help of the State Public Service Commission, do much to bring about the changing of many of the present unsatisfactory rate systems now in use.

Although the step meter rate as shown in Fig. 1 is taken from an unusual and extreme case, it shows very plainly the disadvantages of this system. The charge per kilowatt-hour is based upon the entire consumption and the total consumption billed at this rate. This certainly is a discrimination against the small or moderate user. Furthermore, unless governed by the so-called "more or less" clause, in many cases if a customer were to deliberately waste some current it would be to his advantage. For example, in Fig. 1 the customer who uses 300 kw-hr. is billed $30. If,

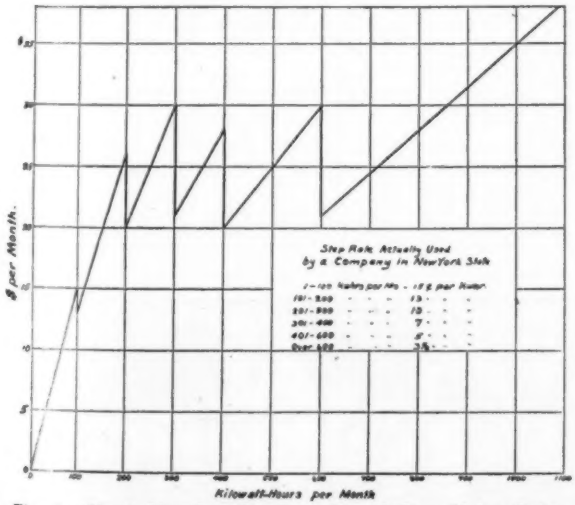


Fig. 1.—Chart Showing the Operaton of Step Meter Rate.

however, he uses 310 kw-hr. his bill is $21.70. Likewise if he wastes enough energy to register 610 kw-hr. his bill is further reduced to $21.35.

By the addition of the "more or less" clause this needless waste is stopped, although the rate is unsatisfactory in either case. The "more or less" clause provides that in case an increase in consumption would give the consumer a smaller total bill he will be rendered it. For example, if a customer's total consumption was 300 kw-hr. he would be rendered the smallest bill to which he would be entitled, providing his consumption was greater than it was. In this case he would be billed for 401 kw-hr. at 5 cts. per kw-hr., or $20.05.

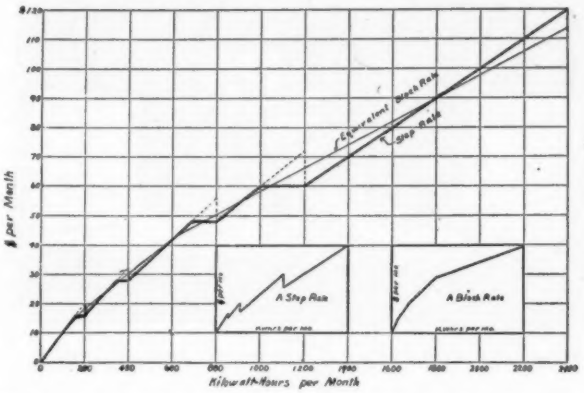


Fig. 2.—Chart Showing How Block Rate Can Be Superimposed Upon Step Rate, Giving Practically the Same Returns.

The best remedy for the step meter rate, however, is the block rate. By this system the consumer is billed at a certain rate per kilowatt-hour for a certain number of kilowatt-hours and a smaller rate per kilowatt-hour for the next predetermined number of kilowatt-hours, and so on. For example, by the block rate system shown in Fig. 2 a customer would be billed $30 for a total consumption of 400 kw-hr. This, it will be seen, corresponds closely with the billing of the step meter rate, which would be $32 in this case. However, a total consumption of 401 kw-hr. by the step meter rate would be $28.07, while by the block rate it would be $30.06. It will be seen, therefore, that although a cheaper average rate per kilowatt-hour may be obtained by the large user by the block system, the total bill is also bound to be more. The method of substituting the block rate for the step meter rate is shown by Fig. 2.

Step Rate.

On a total consumption of

From	1	to	200 kw-hr.	10c per kw-hr.
From	201	to	400 kw-hr.	8c per kw-hr.
From	401	to	800 kw-hr.	7c per kw-hr.
From	801	to	1200 kw-hr.	6c per kw-hr.
Over	1200		kw-hr.	5c per kw-hr.

Block Rate.

For the first	100 kw-hr.	10c per kw-hr.
For the next	100 kw-hr.	8c per kw-hr.
For the next	400 kw-hr.	6c per kw-hr.
For all over	600 kw-hr.	4c per kw-hr.

MINNEAPOLIS RATE INCREASE.

The Minneapolis General Electric Co., of Minneapolis, Minn., has placed in effect an increase in electric rates amounting to approximately 10 per cent. This was necessitated by extraordinary increases in the costs of materials, supplies and operation due to war conditions.

PATRIOTIC WINDOW DISPLAY OF MERCHANTS HEAT & LIGHT COMPANY.

The striking window display shown in the accompanying illustration is one of the contributions of the

Patriotic Window Display of Merchants' Heat & Light Co., Indianapolis.

Merchants Heat & Light Co., Indianapolis, Ind., towards the success of the fourth Liberty loan. The company, of course, did its full share in the matter of purchases and also in donating the time of its employes to this worthy cause.

The value of the window display, however, cannot be overestimated, first because the location is one of the most prominent in the center of the city's shopping district and, second, because the public has become accustomed to watch for startling and novel window effects from the company. Doubtless many purchases of bonds were stimulated by the display and the company's patriotism and civic pride and further impressed on the minds of its customers.

NATIONAL ELECTRIC LIGHT ASSOCIATION'S ACCOUNTING COURSES CONTINUED.

The Advanced Electric Utility Accounting Course and the Elementary Course in Accounting given by the National Electric Light Association are to be continued this year under direction of the Chicago Central Station Institute. These courses have met with considerable success in the past, having an enrollment of about 500 students the first year. Although operating along the lines of a correspondence school course these courses offer the added advantage of collective studying. Classes are formed in the different localities having individual instructors, although the answers to the lessons are forwarded to the Chicago Central Station Institute for grading.

The elementary course consists of seven lessons covering one year's work and is designed to suit the needs of those in such positions as to be benefited by a fundamental knowledge of accounting. The advanced course consists of 36 lessons covering two years' work and teaches the best modern practices in accounting.

These courses are open to any employe of a member company of the association, or to anyone receiving the endorsement of an executive officer of a member company.

ELECTRIC HEATING IN THE TELEPHONE INDUSTRY.

Uniform Quality and Reduction of Fire Hazard Two of Important Advantages—Details of Two Installations.

Telephone supply companies have long sought for the ideal, wear-resisting finish for their products. The quality of finish has very little to do with the successful operation of telephone equipment, but the appearance of such equipment after months of use may be attractive or not according to the condition of the japanned surface.

In experimenting with finishes and the methods of applying them these manufacturers discovered that much depended on the baking process through which the japanned surface was subjected. Their experiments finally led them to try electric heat with the result that the principal firms now use no other source of heat energy.

The Connecticut Telephone & Electric Co., of Meriden, Conn., operates 2 ovens for baking varnish on small coils and paper coil boxes. Figs. 1 and 2 show the entrance and exit of their continuous conveyor oven used for this purpose. This oven is 6 ft. wide, 8 ft. high and 20 ft. long, and has a connected load of 50 kw.

The coil-windings and coil boxes are first dipped and then hung on hooks fastened to the conveyor. The oven is operated at 225° F., and the conveyor runs at a speed which allows for a 2½-hour operation including pre-heating, baking and cooling off.

The parts to be baked pass through the pre-heating chamber up into the main heating chamber and then down and out in the rear of the oven where they are removed from the conveyor. The entrance and exit of the main heating chamber are on an incline in order to pocket the heat and keep it from escaping.

Elaborate care was accorded the ventilating facilities, which are vital to japan baking, if the best results are expected. The illustrations show the ducts which carry off the volatile gases generated during the baking process.

This continuous conveyor oven is operated 8 hours a day, which includes one hour to heat it up in the morning. One man operates the oven, puts on the coils and takes them off the conveyor, handling over 3000 coils a day.

This same manufacturer operates a small box-type oven for baking coils to be used on motor vehicles.

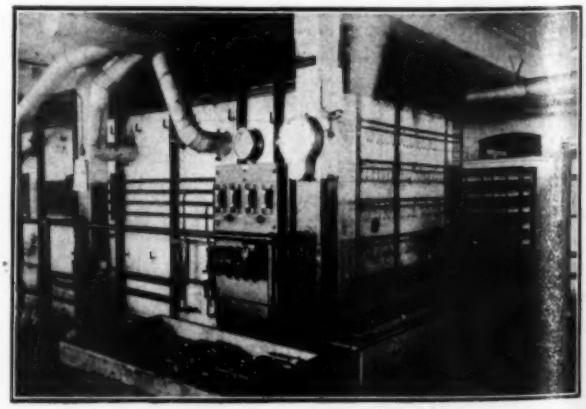


Fig. 1.—Electrically Heated Oven for Baking Varnish on Coil Windings.—Entrance.

The oven's capacity is 420 coils every two and a half hours, at a temperature of 250° F. This oven has a connected load of 14 kw., and is equipped with automatic control. Only one operator is required, in comparison with two operators for the two gas ovens, which did the same work before electric heat was installed. Under the present conditions, it is possible to maintain an unvaried heat, consequently the loss due to imperfect baking is materially reduced.

The Gray Pay-Station Telephone Co., of Hartford, Conn., has 6 ovens equipped with General Electric air heaters, and another in process of construction. The ovens range in size from the smallest, 3 ft. wide, 2½ ft. deep and 4 ft. 10 in. high, to the largest, which is 6 ft. wide, 5 ft. 3 in. deep and 7 ft. 8 in. high. The connected loads vary from 6 to 18 kw. These ovens are hand operated, but an automatic clapper switch actuated by a time clock throws off the current at a predetermined time.

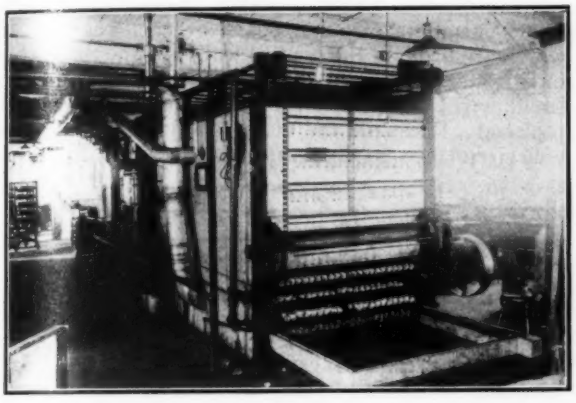


Fig. 2.—Exit of Electrically Heated Oven for Baking Coil Windings.

The parts regularly baked consist of housing boxes, register boxes, shelf bracket, money drawers, top plates and doors for cash drawers. The finish is usually black unless otherwise specified. The baking temperatures vary from 180° to 350° F., and the period from 2 to 4½ hours.

The Gray Pay-Station Co. has been using electric heat, exclusively, in its japan baking ovens for more than 6 years, being one of the pioneers in the electric heating field. The company is very enthusiastic over the results obtained.

The elimination of fire hazards and noxious fumes, the uniform dry heat and particularly the even quality of the finished product are points much appreciated. An official statement of one of the leading supply firms gave the following concise decision in favor of electric heating: "We get a perfectly clear black finish every time on every piece with exact uniformity."

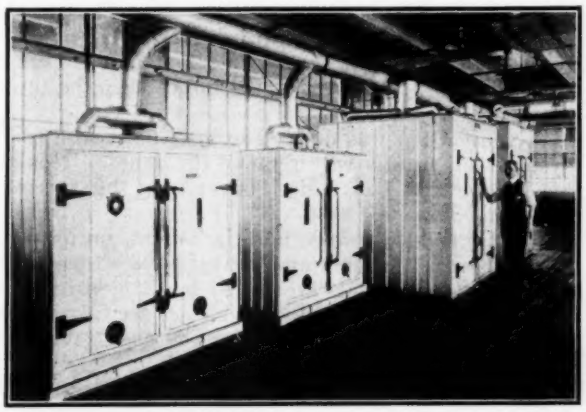
Although the telephone industry is only one of many using electric air heaters at the present, the extensive use of this kind of heating is an indication of what can be accomplished when the very finest quality of work is demanded.

ELECTRIC FURNACES FOR MANGANESE ORES IN OPERATION.

The electric smelting furnaces for reducing ferro-manganese ores at the plant of Anaconda Copper Co., Great Falls, Mont., have begun operation. The five furnaces have a production capacity of 90 tons of ferro-manganese per day of a grade required by steel works. The ores are received from the Butte mining district. The furnace charges are reported to be made up in the proportions of 500 pounds of manganese ore, 170 pounds of coal, 70 pounds of lime rock and 20 pounds of iron ore. The new plant is said to have cost $500,000, and its entire output has been contracted for by the Government.

GARBAGE COLLECTION BY ELECTRICS IN NEW ZEALAND.

The city of Christchurch, New Zealand, is using a storage battery tipping wagon for the collection of refuse. This vehicle is also employed for transporting coal to the municipal electricity works, and for removing ashes therefrom. The capacity of this tipping truck is 4480 lb. An Edison tower wagon is also used, as are one or two other electrics for municipal service.



Battery of Electrically Heated Ovens in Telephone-Instrument Plant.

The civic authorities have such faith in the electric for municipal and similar service that they not only use this type of vehicle themselves, but cater to its use by others. A garaging system for electric storage battery vehicles has been established where vehicles are garaged and kept in running order for a definite payment. The cost is understood to be about $1260 per annum for garaging and upkeep, but not including cost of energy, which is charged for at various rates per kilowatt-hour.

IMPROVED LIGHTING TO GUARD MAILS.

A police chief in a large city said some time ago that an arc light is equal to a policeman. Recognition of the protective value of lighting is becoming more general and only recently, through the co-operation of the Post Office Department and the Railroad Administration, an order was issued for the better guarding of mails while in the care of the railroads. It asks for greater care in selection of railroad employes that handle mail and for the provision of screened protection for mails held in storage, as a closed room allows too great an opportunity for pilfering. Respecting lighting it says:

"At stations or terminals where it is necessary to truck mails through tunnels, subways and recesses in buildings, such tunnels, subways and recesses should be properly lighted in order that mail may be closely watched."

Operating

An Ash-Handling Problem—Making Induction Regulators Mobile—Line Construction—Condition of Conditioned Air

FLUSHING OF ASHES OVERCOMES POWER HOUSE TROUBLES.

In a central station of several thousand kilowatts in Pennsylvania the power plant was encountering considerable difficulty on account of gas forming in the ash tunnel to such an extent that men could not work in the tunnel for more than a few minutes at a time. And men would not stay with their job. The gas was largely carbon monoxide, which is poisonous. The gas entered the tunnel at such a rate that it was impractical to furnish sufficient ventilation to keep the tunnel clear.

Eventually it was decided to install an ash-flushing system and in this way remove the ashes. This has been done and has entirely overcome the forementioned trouble.

Water is now pumped into the ash pits until it completely covers the ashes and extinguishes all fire. The bottom of the ash-pits are closed by close-fitting, gas-tight ash valves. The water and ashes are then flushed out through a trough to a concrete pit outside the building and from this pit the water is pumped by centrifugal pumps and either circulated to assist in flushing the ashes through the trenches or pumped away to the sewer. The ashes are hoisted out of the ash-pit by a clamshell bucket and dumped into an overhead bunker, from which they are removed for disposal.

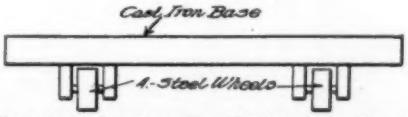
MOBILE INDUCTION REGULATORS.

Method in Vogue for Permitting Rapid Change of Regulators.

In many substations, and more especially those containing a fairly large number of regulators, it is the custom to install a spare single-phase regulator or set of three single-phase regulators, to permit of quickly transferring any circuit or regulator in times of necessity. However, in smaller substations, or where there is hardly justification for keeping spare equipment connected up ready for cutting in by manipulations of disconnect switches, it may be found advisable to keep a spare regulator standing, ready to be connected in circuit, should the emergency arise. One company has in vogue a method of doing this which it is thought may hold out inducements for many other companies to follow, in that a large degree of economy is possible without the heavy investment necessary where a spare unit is connected up ready for service after switching.

This company installs its regulators on trucks or carriages. These trucks are of cast-iron, about 1½ in. in thickness, heavily ribbed. Bosses are cast upon the lower side of these trucks, which are drilled out to take a ⅜-in. steel pin which in turn passes through a steel roller about 2 in. dia. All regulators installed remain upon their carriages, the regulator being rolled into place and there anchored. The anchoring is accomplished by the installation, by means of expansion bolts or grouted studs, of two steel plates upon the concrete floor. The wheels of the regulator carriage are then wedged in place to prevent lateral movement. The defective regulator can then be quickly taken out of circuit and the spare unit wheeled into its place. With this arrangement one man with a pinch bar is well able to move a 36-kw. induction regulator across a station floor.

To reduce the time required to make a change of regulators, the company using these regulator carriages installs a terminal board by each regulator, to which are brought the control leads for the three-phase motor and reversing or primary relay. Thus these small wires can be simply and quickly removed and replaced. Likewise, the main conductors of the 2300-volt circuit can be disconnected.



Form of Cast-Iron Carriage for Making Induction Regulators Mobile.

The most common causes of an induction regulator breaking down and having to be taken out of service are insulation failure of the rotor or potential circuit, overloading resulting in overheating, charring and failure of the insulation, the trouble commencing in the secondary or series winding and in turn affecting the primary winding of the regulator; and damage due heavy current rush which may break off the casing, cause ruptured windings and movement of the rotor, due to paralleling two regulators or short-circuiting the regulator with unequal pressures.

CONDITION OF CONDITIONED AIR.

By W. A. Field.

When generating capacity is as heavily loaded as at the present time with most central stations, which usually means heavier average loads longer sustained, higher load-factors, it is imperative that machines be kept running for long periods without being taken down for cleaning and overhauling requiring more than 24 hours at most. For turbogenerators this means that surface condensers should be cleaned out sections at a time during shut-down periods, in this way keeping cooling surfaces clean and assisting economical maintenance of vacuum. For the generator, only general blowing-out and wiping of sections of the field and stator is possible, the real cleaning, which consists of removing the rotor, being left for the biannual, semiannual, annual or periodic shut-down.

As regards the cleaning of turbogenerator fields, it may be necessary to remove the field rotor from out of the stator anywhere from every six months to every two and one-half years, depending upon the condition of the air. The process of cleaning under these circumstances also includes a general overhauling of the field coils, tests for insulation, heating, and

so on. The job may require having the machine out of service several days or several weeks, depending upon the amount of work to be done, and the availability of men and materials for doing it. It can be seen that the less dirt, dust and foreign objects entering a generator the less the likelihood of grounds, choked ventilating ducts, overheating and fires occurring. This means that a machine can remain in service longer without requiring cleaning. The more efficient the cleaning, or the cleaner the air, the longer can be the periods between overhauling, therefore. At the present time, clean air is playing its part toward winning the war.

Unfortunately, the air in the neighborhood of central stations is not ordinarily very clean. The power plants are so often situated close to facilities for shipping handling and storing coal; there are cinders, clinker and flue-gas dust, and other air-borne particles of industry, all tending to cause contamination of the air. For the average central station clean air means, therefore, air that has been made clean by some contrivance operated by the central station. In the ELECTRICAL REVIEW, issue of October 5, page 581, statements were made regarding methods of testing the condition of air that had been conditioned or cleaned. These remarks are to the point and might be read carefully to advantage by many power plant operators. The writer feels, nevertheless, that a few more words can be added as to the way of determining the condition of air, whether treated or otherwise, for dirt content.

In the previous article mention was made of methods of testing air and the use of a screen in the path of the air was recommended. This is the commonest method in use among the engineers of the large manufacturers of turbogenerators, because simple, effective and readily carried out. However, much depends upon the screen employed, and for this reason the following description may serve a useful purpose.

The test screen or screens may be made between 6 in. to 2 ft. square, the latter being preferable where the area of the path taken by the air and of the duct permit. This screen may be composed of a wire frame upon which absorbent cotton is mounted. The wire should be of mesh with about ½-in. mesh. The mesh on the side facing the air stream—that is, on the pressure side—is then covered with shellac, and upon this is laid a thin layer of absorbent cotton or surgical lint. After the shellac has had time to dry, the cotton should be gently pulled off the mesh in such a way that all surplus cotton is removed, yet a thin layer remains adhering to the shellac, so that the interstices of the wire mesh are covered up.

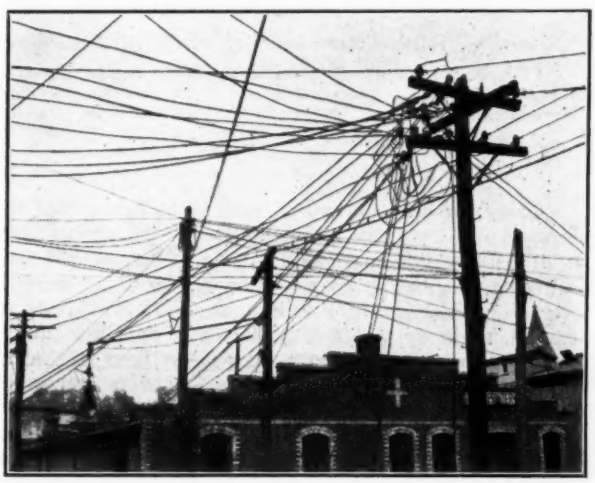
The quantity of dirt picked up by the screen is the criterion as to the condition of the air passing into the generator. By comparing two screens, one before the air is treated and the other after the air is treated, it is at once possible to tell whether the existing air-treating apparatus suffices or whether improvement in air filtering or washing methods is justified. It might be said in closing that washing air, as contrasted with merely filtering it, which only cleans the air and thereby extends the periods between cleaning, reduces the likelihood of grounds and dielectric failures, and reduces possibility of hot-spots, increases the capacity of the generator several per cent by control of humidity.

Practically every large turbogenerator is now cooled by conditioned air, because necessary for the safety of the unit. The relative cost of air-conditioning apparatus is no higher for smaller units, and such apparatus deserves careful consideration by every power-plant engineer.

DANGEROUS AND WASTEFUL LINE CONSTRUCTION.

For many years the National Electric Light Association has had a committee on overhead line construction, which has done good work toward bettering line construction, standardization and increased safety. The various safety organizations and transmission and distribution economics have also exerted an influence toward bettering overhead construction and pole lines. Notwithstanding all these influences for good and improved methods, it is a fact that very poor construction methods can often be seen, however.

The accompanying illustration shows an example of overhead line construction that is dangerous to life; is such as to encourage service interruptions; and is extravagant of materials. Conductors follow many



Example of Dangerous and Wasteful Line Construction.

paths; small telephone wires are installed above larger stronger high-voltage conductors; conductors instead of being drawn up taunt are allowed to sag; joints are not taped. No attention has apparently been given the matters of simplicity, economy or safety.

The conditions seen are hazardous not only to linemen, but to pedestrians, persons using telephones and coming into close proximity to or in contact with secondary conductors. During windy weather, when snow and hail occur, the loosely strung conductors may easily swing together, causing short-circuits, burnt off conductors and service interruptions. In addition to the dangers and service troubles incident to the poor construction employed, a waste of material is also involved.

SLUDGED OIL CAUSES OVERHEATING.

A 3000-kw. water-cooled transformer would not meet the guarantee. Safe operating temperature was reached at 80% load. It was noticed that varying quantity of water made little difference in affecting temperature of windings or temperature of water. In fact, the low temperature of the water as compared with the high temperature of the oil immediately suggested trouble with the cooling system. Investigation showed the transil oil acted as a solvent for the impregnating compound, which adhered to the exterior of the cooling coils, preventing transfer of heat from oil to water. Changing the oil and cleaning the coils solved the difficulty.

Contracting-Construction

A Veteran Inspector Discusses Need for Electrical Inspection—Draining Conduit in Cold Rooms—Contractors' Jobs

IMPORTANCE TO PUBLIC OF INSPECTION OF INTERIOR WIRING.

Slightly Condensed from a Paper Presented Before the Recent Convention of the International Association of Municipal Electricians.—First Part of Paper.

By William S. Boyd,

Secretary, Western Association of Electrical Inspectors.

[Performing work of great importance to the electrical industry and to the public, it is not often that the electrical inspector has received the credit that is due him. In this paper Mr. Boyd gives an excellent summary of how the inspector's work has been constructive and has gradually received more and more recognition for its intrinsic worth.]

Carefully-kept statistics seem to indicate that defective wiring is still taking its heavy toll of property in uninspected districts, and this fact alone would warrant the application of rigid inspection to all interior wiring installations. The tabulation of fire losses by causes made by the National Board of Fire Underwriters shows that as a fire origin, electricity still maintains itself at the head of the list as a property destroyer.

A portion of the public realizes the importance of inspection of interior wiring, but the balance, and apparently the larger portion, does not. It is with a few general divisions of the former class that we shall concern ourselves in this discussion.

The Business Man's Estimate of Electrical Inspection.

Let us first consider the attitude of the business man, and for two reasons: (1) He was the first to adopt electricity for light or power purposes. (2) His influence on inspection has the most far-reaching effect.

The first extensive introduction of electricity for interior illumination took place among the textile mills of New England, and its operation was immediately followed by numerous fires. In a group of 65 installations, 23 fires occurred within a period of six months. The managers of these plants thought, in the substitution of electricity for gas or oil as an illuminant, they had chosen the best and safest form of lighting available, but they soon learned that unless the wiring, appliances and machinery were properly installed and maintained, a serious fire danger was likely to develop.

The insurance companies which paid these early losses were greatly alarmed, and sent a representative to consult with the manufacturers of the apparatus which caused the trouble, and after considerable study and experimentation, a set of rules was drafted, which, on being enforced, put an end to the epidemic of fires in these plants. This took place in the year 1881.

These rules applied only to industrial plants, but others soon made their appearance which were available for more general application. Some of these rules came from municipalities. The city of Chicago inaugurated inspection in 1880, but did not have any detailed rules until later. The ordinance, providing for the filing of application for permission to do electrical work, and requiring a certificate of inspection before wiring or apparatus could be put in service, did not pass until Dec. 10, 1883. The late C. C. Haskins, well known to the old-timers in the inspection work, was the first inspector Chicago ever had, and he remained in the service of the city for a great many years.

Electrical inspection departments were established by insurance organizations in the larger cities at an early date, the New York Board of Fire Underwriters being the first in the field with a set of rules dated 1881.

The conservative merchants and manufacturers were deterred from signing contracts for electric lighting plants by these early fires, and many of them continued with the oil and gas until assured by the representatives of insurance companies that it would be perfectly safe to use electric light if the plant were properly installed. Strenuous efforts were put forward by the electrical manufacturers to preach the gospel of safety to the business man, and when his fear gave way, the use of electric light became quite general, and increasingly satisfactory. The business man kept pace with the progress of the art, and from time to time, as new systems were developed which were safer, he adopted them, and there are many manufacturing plants that have had as many as six or seven types of illuminating units and in some cases several kinds have been in operation at one time. These changes in the form of lighting have not been made exclusively on account of the fire hazard involved, but in many cases because the lighting was not suitable or efficient or because it was injurious to the eyesight of the operatives.

The advent of electric light made it possible for the factory manager to utilize portions of his building which before were of little or no service to him and it permitted him to operate the plant at night and thereby nearly double the output.

There were processes which could be carried on only in daylight, but with the appearance of the incandescent lamp, it was possible to provide a reasonably safe form of lighting, especially for rooms in which inflammable gases were present, or in which there were combustible flyings. It has been the inspector's study of these problems that has developed these safeguards and made available the use of electricity in these locations.

The merchant at one time illuminated his show window by means of gas light, and when the incandescent lamp was presented for his consideration, he ordered his windows equipped, but the plan followed brought the lamps into close proximity to inflammable material, and the lights were so placed as to hinder the prospective customer from properly viewing the display. The combined efforts of the inspector and the illuminating engineer eventually forced the lights into the upper portion of the window and thereby achieved real illumination and the maximum of safety.

Instances of this sort could be multiplied indef-

initely, and it has been service of this character that has given the electrical inspector in many cities such a good standing with the business man that he refuses to make any move regarding changes in his electrical equipment without first consulting with the electrical inspector, whose decision in the matter generally settles the question at issue. The business man has found that he can rely upon the electrical inspector to protect his rights where an electrical equipment is being installed, and prevent his being imposed upon by incompetent or careless wiremen, and it is not strange that when the electrical inspector needs a friend, the business interests are quite solidly behind him. Many a politician has learned that it does pay for a public servant to be true to his trust and that the faithful inspector cannot be displaced or hindered in his work with impunity. Need we go further for an expression of the business man's estimate of the importance to the public of inspection of interior wiring?

The Householder's Estimate.

Electricity for light, heat and power purposes came into the home very gradually. Many of the early installations consisted of but one or two lights, but with the invention of the integrating electric meter and the establishment of watt-hour in place of flat rates, the service in the home became more general until today we find that it has quite largely superseded gas and oil for the production of light and heat. Where the electric public service company has been up-to-date in its policy, practically all of the new residences have been wired during the construction period.

In the early days a job was considered as wired properly when the lights burned and were only occasionally extinguished by defects in the installation, such as broken wires, switches, sockets, etc. This view changed when the carelessly wired buildings began to be troubled with fires. These experiences had two results—they caused the electrical people to be more careful with their work in the town in which the fire occurred, and they caused a good many users of electricity in the neighborhood to cut off the current from the home and others refused to have their homes connected until the wiring was inspected and pronounced safe, either by a representative of the lighting company or a regular electrical inspector.

Some of the early patrons of the lighting company were fearful of lightning and insisted on cutting off the current during every thunder storm. This practice has been discontinued as better wiring and better lightning protection has been installed. This restored confidence is due to improved conditions resulting directly or indirectly from inspection and the trust imposed in work of the inspector.

As the use of electricity in the home increased, there grew up certain practices which introduced fire dangers which had to be met by the inspector. The first lamp shades procurable were not very artistic and paper shades were made and placed on the lamps and in some instances the paper only charred but did not ignite, while in others a small fire ensued and the inspector's fight against the use of these shades was eventually successful as the danger accompanying their use became apparent. The glass and pottery shade manufacturers provided artistic shades to make the housewife happy and at the same time eliminated the hazard of bringing inflammable material in contact with the lamp bulb.

The habit of bringing lighted matches and candles into clothes closets gave way to the close light and, to prevent these from being left burning while in contact with clothing, the door switch was installed or lamp guards were provided.

The schoolboy experimenter was early on the scene with his magnet-wire and flexible-cord contraptions and gave the lighting company its troubles, and this epidemic of tampering was only stamped out when the public service company threatened to cut off the current or the inspector instituted criminal proceedings against the offenders. The inspector's publicity work in the newspapers helped call attention to this violation of the ordinance and its probable results.

Utilization equipment and devices began to appear on the market and later in the home, and some of these were decidedly dangerous, both because of defects within themselves and because the circuits on which they were to be used were not properly prepared for such attachment. The electrical inspector was ultimately able to control the situation while these devices were in the hands of the lighting company or the electrical contractor and did not protect the customer to a great extent by inspection and newspaper publicity, but when the department stores, and especially the five and ten-cent stores, began to dabble in electrical goods the inspector found a "foeman worthy of his steel" and special notice was served on these stores to handle only approved goods, and their stocks were watched closely. In some cities the matter was handled through the adoption of an ordinance regulating the sale of electrical supplies and requiring the approval of the electrical inspector before any electrical material or device could be offered for sale.

The acid test of the householder's estimate comes when he moves from a city or town which had municipal supervision of electrical wiring and takes up his residence in a city or town which is without such service. When the matter of electricity for light, heat or power is presented to him in the new home, his first question is, will the inspector approve it—does the inspector think that this wiring is safe? And he is generally much disappointed when told that there is no inspection service available.

The Electrical Contractor's Estimate.

In the early days of electric lighting and power no one fought the establishment and enforcement of rules governing the installation, operation and maintenance of electrical wiring and apparatus more consistently and bitterly than did the old-time electrical contractors. They were almost a unit in saying that the proposed raising of the standard for wiring to bring it into harmony with the National Electrical Code would ruin the business and no one would ever order electric light into his home or place of business at the price that must be asked under the proposed rules, and the electrical contractor would be obliged to shut up shop. A few months' experience with the enforcement of the rather crude rules of the early days soon dissipated the contractor's fears and he gradually began to see that the rigid enforcement of the Code stabilized his business, enabled him to charge a fair price for his work, to use reliable material and fittings, to install the equipment in a workmanlike manner and thereby to provide his customers with a safe, reliable, adequate and efficient light or power installation. This, of course, put his business on a firm foundation and made it pleasant as well as profitable to do business. Now no one fights harder for rigid, impartial and competent inspection than does the honest electrical contractor. Those contractors who held to the old ways of "skinning the job" are long since out of business.

Under inspection the contractor could bid to do

first-class work without fear of losing the contract to a dishonest bidder, and on being awarded the contract he could afford to do the work properly and after the installation was complete and in operation, he could feel certain that he could again call on this customer without being thrown out, and when extra work or repairs were needed he would be almost certain to get the work.

The only criticism the electrical contractor has to offer to the electrical inspection situation as it exists today is that there is a lack of uniformity in the interpretation of the National Electrical Code rules and this condition is being gradually overcome. He has said something about special rules in different cities, but he does not object to special rules when he knows what they are and what they mean, and there should be no trouble about this detail with a competent inspector in charge of the work.

If the inspection of interior wiring should suddenly cease, a great industry would be shaken to its foundations, because it would be left without a standard, and an industry without a standard is like a ship without a compass. The National Electrical Code would cease to exist as a standard if it should cease to be enforced by inspection. The electrical contractor knows this and that is why he is generally enthusiastic for inspection under an impartial inspector and may always be counted upon to lend his influence to the cause of rigid enforcement of the National Electrical Code.

(To be continued.)

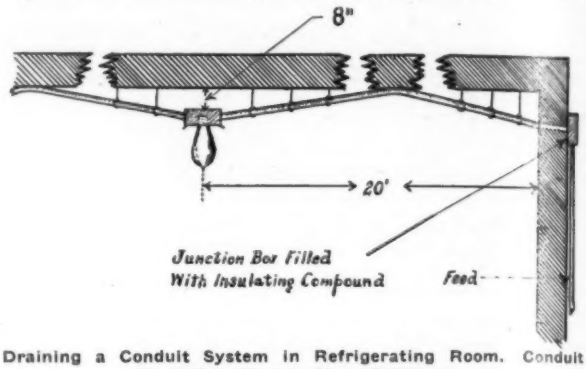
DRAINAGE SYSTEM TO PREVENT WATER COLLECTING IN CONDUITS.

New Method Permits Use of Conduit in Refrigerating-Room Installations in Place of Open Wiring.

Considerable difficulty has been experienced in the past in the use of conduit systems in packing houses, refrigerating rooms, etc. This difficulty arises from the extreme cold of the room. Warm and damp air enters the conduit system from the outside, condenses when it strikes the cold air of the freezing room, and the water which it contains stays in the junction boxes and conduit. In a short while the rubber insulation on the wires deteriorates, due to the moisture, causing short-circuits, grounds, etc. Several schemes have been tried to avoid this without success and at the present time nearly all packing-house freezing rooms are wired with open wiring.

There are several objections to the use of this form of wiring. In the first place, all these rooms are constructed of concrete or brick and lined with heat-insulating material. The installation cost of open wiring is, therefore, often much more than conduit work. Then, there is the common objection that this form of wiring is much more subject to mechanical injury than the wiring in a conduit system.

In a recent installation in this type of building the electrical contractor, Oscar M. George, of Chicago, put in the conduit system in the following manner which appears to have solved the difficulty. The room was of concrete structure and the usual deep concrete outlet boxes were used. Instead of fastening the covers tight to the box, however, a small space was left between the edge of the box and the cover by installing a leather washer under the screws between the box and the cover. The conduit run between the boxes was inclined slightly so that the conduit sloped down from the middle of the run to each box. The run in this particular case was 20 ft. and the center of the conduit run was 8 in. higher than the level of the outlet box. This afforded a good drainage for any water that might collect in the conduit. To further this scheme, junction boxes were placed immediately on the outside of the freezing room where the conduits entered and these were filled with insulating compound to prevent as much warm air as possible from entering. Where



Draining a Conduit System in Refrigerating Room. Conduit Slope Magnified to Show Scheme.

pieces of conduit were joined together the couplings were leaded and drawn up tight to prevent any water from gathering in the space between the conduits.

This scheme has been approved by the proper authorities and so far has proven satisfactory. Its adoption should do away with much of the poor open wiring now in use in this class of buildings.

AMONG THE CONTRACTORS.

Contract for electric wiring in the new cotton mills being erected by the Oella Cotton Mills, Baltimore, Md., at a cost of approximately $500,000, has been awarded to Riggs, Distler & Stringer, Baltimore.

The Standard Electrical Co., 1483 Acushnet avenue, New Bedford, Mass., has been awarded a contract for electrical work in connection with alterations and improvements being made in the motion-picture theater on Weld street.

The Ringe Electric Co., 123 North Sixth street, Philadelphia, Pa., has been awarded a contract for electrical work in connection with the construction of a large new $50,000 apartment house on Walnut street near Forty-fourth street.

A. M. Quist & Son, 2930 Atlantic avenue, Brooklyn, N. Y., have been awarded the contract for electrical work in connection with the new $60,000 foundry now in course of construction by the Columbia Machine Works & Iron Co. on Euclid avenue near Atlantic avenue.

The Keller-Pike Co., 1213 Race street, Philadelphia, will install the necessary electric fixtures, electric wiring, etc., in the new oil house, master mechanic's house and storage building now in course of construction by the Philadelphia & Reading Railroad, at a cost of $75,000, at Third street and Erie avenue.

The K. C. Electrical Construction Co., of Kansas City, Mo., of which Wm. L. Hutchinson is president, will move about Nov. 1 into new quarters at 1409-11 McGee street. The company has recently purchased the Hayes & Murrill starter and battery business, giving Eveready service also. The electrical construction and supply business and the starter and battery business will be combined in the new quarters. L. O. Hayes and F. E. Murrill are retained in the battery and starter department.

New Appliances

New Pull Switch and Switching Units—Enameled Resistor Units for Use in Damp Places—Protected Paint Bucket Set

NEW C-H PULL SWITCH.

A new pull switch recently placed on the market by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has a one-piece white glazed porcelain base which fits directly over a standard 3¼-in. outlet box. The two screws which are furnished with the outlet box are used to fasten this switch to it. The shell lock used for attaching the shell to the base is the same as that used on all C-H push sockets as well as on other types of C-H pull switches. The mechanism used, which is the same as that used in other C-H pull switches, is made of two pieces of porcelain securely

The New C-H Pull Switch Complete and With Shell Removed to Show Interior.

fastened together and containing a rotary switch mechanism, operating on a steel shaft. There are two holes in the halves of the porcelain so arranged that they permit feeding the supply wires through them; this prevents vibration and operation of the switch from loosening the contact screws. This type, as well as the other types of C-H pull switches, has the high capacity rating of 6 amperes at 125 volts, instead of the usual 3 amperes at 125 volts. Their large capacity makes them of particular value for controlling large groups of lamps, or lamps of high wattage.

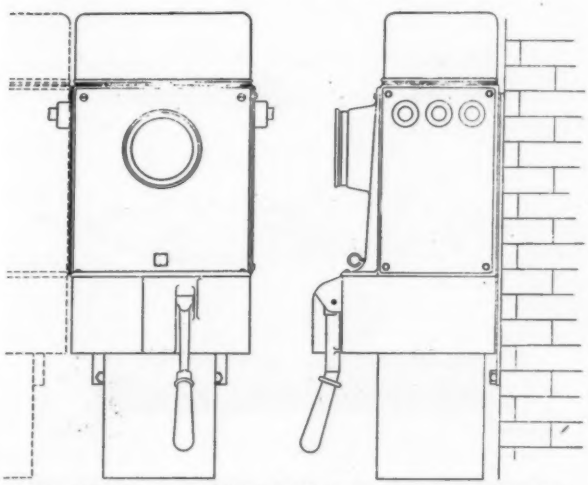
WALL-TYPE SWITCHING UNIT.

The wall-type switching unit here shown is intended for the control of alternating-current circuits up to 300 amperes and 2500 volts. The unit consists of an industrial type oil circuit-breaker with a space above which serves as a housing for disconnecting switch, current and potential transformers and also provides a location for either voltmeter or ammeter or both when desirable.

Following along the lines of "safety-first" principles, the disconnecting switch is interlocked, mechanically, with the oil circuit-breaker so that the switch cannot be opened when the breaker is closed, nor can the breaker be closed while the disconnecting switch is open. A key projecting through the front of the panel is used to operate the disconnecting switch. This key can be removed when the switch is open and carried by the operator, who then is assured that no one will close the switch while he is working on lines or apparatus on the circuit controlled by this unit. The interior of the switch compartment is inaccessible while the switch is closed and the oil tank cannot be removed while the disconnecting switch or oil circuit-breaker is alive.

These switching units are particularly adapted to the control of circuits feeding banks of transformers or motors in steel mills and pumping plants, where it is desirable to mount the motor control appliances on walls or pillars.

Wall-type units are designed for single or group mounting and have a large bus compartment just above the disconnecting switch and inside the cast-iron housing. Conduit connection with the unit can be made from above, below or from either side.



Switching Unit of "Safety-First" Type for Wall Mounting.

The units are self-contained and may be considered as "safety-first" in every particular. They are manufactured by the General Electric Co.

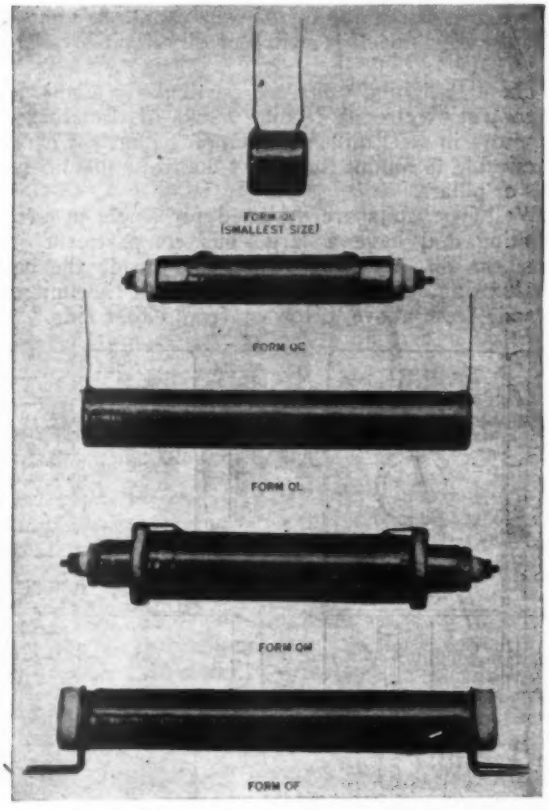
ENAMELED RESISTANCE UNITS FOR CURRENT REGULATION.

Enameled resistance units for regulating current have been developed in various forms and sizes by the General Electric Co., Schenectady, N. Y. Some of the applications to which these units have been put are railway and fire-alarm signals, fractional-horsepower motors and locomotive headlights. They are also used extensively in series with relay, contactor and circuit-breaker coils on panels and switchboards. They will be found particularly applicable in mines and similar places where a great amount of dampness and moisture are present. These units are unique in their

ability to withstand unusually high temperatures, as well as sudden changes in temperature from one extreme to the other.

The resistance wire or conductor is wound either upon a steel body coated with a special refractory enamel or paint, or upon high heat-resisting silicate compound developed to withstand sudden extreme temperature changes without cracking or weakening or in any way being injured. The steel body is preferred for extreme lengths where strength for a long span is required and is especially serviceable where the unit might be subjected to severe vibration or shock.

The refractory silicate body is used for most of the ordinary types of resistance. The compound employed is far superior to porcelain or any equivalent ceramic products which are easily cracked or weakened mechanically by repeated and extreme temperature fluctuations.

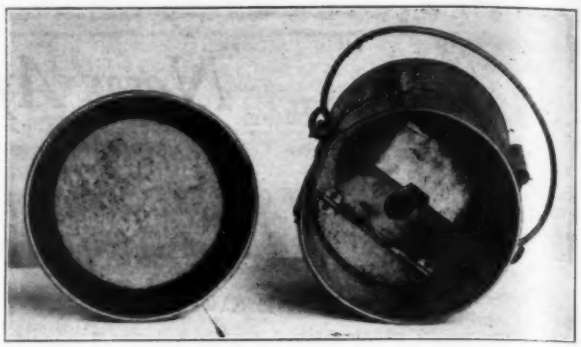


Enameled Resistors of Different Sizes and Construction.

After being wound upon the proper body the conductor is imbedded in a blue vitreous enamel and is fused, until it has a uniform glossy structure, at a temperature of about 1000°C. This enamel is moisture and heat-resisting and forms a mechanically strong casing for the conductor. Enamels of the type used are extremely durable and maintain their dielectric strength and mechanical properties indefinitely.

BUCKET TO KEEP PAINT AND BRUSH IN GOOD CONDITION.

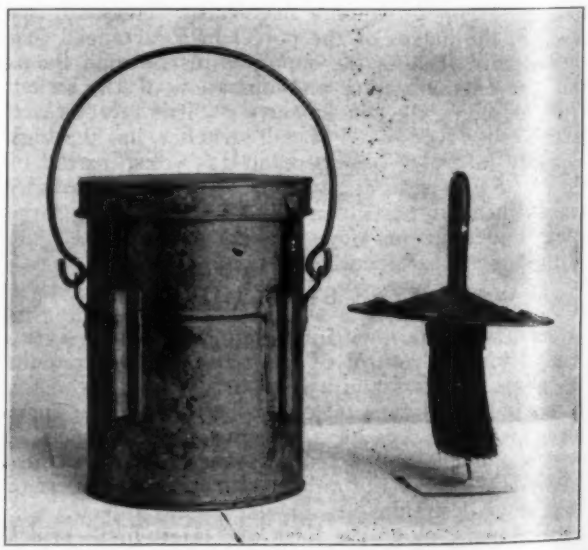
Central-station companies have been put to considerable trouble and expense in the past on account of the paints and brushes which they use drying up. The use which these companies have for paint, although limited, is nevertheless essential, being employed chiefly for the painting and stenciling of poles and apparatus. For these purposes paint is used irregularly, very often several weeks or even months passing when no paint at all is used. During this period the paint and brushes dry up and when needed again they are found to be useless and new ones must be purchased.



Interior View of Bucket and Cover, Showing Gasket and Combination Brush-Holder and Wiping Plate.

Electrical contractors also experience the same difficulty. Their use of paint is confined to the leading of joints in conduit, stenciling cabinets and a few other minor uses. Only a small quantity of paint is used in each individual case and, as with the central-station company, considerable time often elapses between the times when it is used.

A combination paint bucket and brush-holder has been perfected by the Bush Electric Tool & Manufacturing Co., of Redlands, Cal., which will do much to eliminate this annoyance and waste. As is shown in the accompanying illustrations, the cover of this bucket is held firmly against the top by means of springs. A rubber gasket placed in the cover makes the bucket air-tight when closed. About 1/3 of the way down on the inside is placed the wiping plate and brush-holder. When the brush is removed the flaps can be thrown back, forming the wiping plate. In this manner the drippings are kept in the can. When not in use the brush, suspended from its holder in the paint, will keep in good condition indefinitely and the paint, by being kept air-tight, will not dry up.



Exterior of New Paint Bucket, Showing How Cover Is Kept in Place.

Trade Activities

Allen & Peck Change Firm Name—Edison Electric Appliance Reduces Heater Cord Distribution—Special Literature

Allis-Chalmers Co. has sold through its Seattle office a 200-hp., 720-r. p. m., 2300-volt induction motor for installation at the West Seattle pumping station of city of Seattle, replacing a motor of smaller capacity. The motor is to be direct-connected by Allis-Chalmers flexible coupling to centrifugal pump. The larger capacity is required by reason of the increased demand for water by many shipyard workers who are living in West Seattle, Wash.

Glenville A. Collins, district manager at Seattle for Wellman-Seaver-Morgan Co., reports the sale of one of that company's 10-ton traveling hammer-head fitting-out cranes for operation in the shipyards of Norway Pacific Shipbuilding & Dry Dock Co., at Everett, Wash. This is all-steel equipment, having a 75-ft. boom, and is operated by five General Electric direct-current motors—two of 35-hp. each and three of 20-hp. each. This is the Wellman-Seaver-Morgan's new type of crane, the one for Everett being the first of its kind to be installed on the Pacific Coast.

Mohawk Electrical Supply Co., 325 South Warren street, Syracuse, N. Y., is sending out to its patrons a special edition of its monthly organ, Mohawk News Service, containing a letter by A. M. Little, president of the company, on the timely slogan, "Fix Your Lighting." Mr. Little refers to the banishment of the old carbon-filament lamps and the importance of securing the best possible industrial lighting so as to expedite production to the utmost. The Mohawk company has secured the services of a lighting specialist to aid its customers in laying out factory lighting to obtain the most efficient and satisfactory illumination. The company handles only the highest grade of lighting equipment and deserves special credit in making it a settled policy to sell not only lamps and accessory equipment, but real lighting service.

Ross Power Equipment Co., Indianapolis, Ind., reports that among its recent sales are the following: Linderman Steel & Machinery Co., Muskegon, Mich., boiler equipment; Nordyke & Marmon Co., Indianapolis, two 300-hp. water tube boilers; Russ Mfg. Co., South Bend, engine equipment; Vincennes Bridge Co., two 150-hp. new boilers; Swords Bros. Co., Rockford, Ill., 625-k.w. low pressure steam turbo unit with condenser exciter and auxiliaries; U. S. Government, Camp Knox, power plant equipment and machine shop equipment; Varney Electric Co., Tell City, Ind., engine equipment; Brown Co. Products Co., two boilers with stack, etc.; Detroit Shipbuilding Co., two mixed pressure steam turbo-units. The Ross Co. controls a large stock of alternating and direct-current power plant equipment and motors for quick delivery and will be glad to hear from those in the market for the above.

Edison Electric Appliance Co., Inc., 5660 Taylor street, Chicago, in view of the shortage of heater cord, has sent the following communication to central stations and dealers: "The heater cord situation is very serious at this time inasmuch as the manufacturers of this cord have been called upon to utilize their machinery, to a large extent, for war purposes.

"At the present time we are experiencing great difficulty in getting cord in sufficient quantities to supply the demand. We suggest that you put forth every effort to conserve heater cord wherever possible. This could be accomplished by suggesting to your customers, who want to purchase new cords for their appliances, to have their old cord repaired if possible, and if the customer is buying two appliances where the cords and plugs are interchangeable, suggest to them that they use one cord and plug for both appliances, and you can use the extra cord and plug for repair purposes.

"In view of these facts it has been necessary for us to limit our distribution of cords complete to six to any one customer. We can, however, supply plugs to which you can attach proper length of cord from your stock."

Allen & Peck, Inc., engineer and manager of public utilities, announces the retirement of C. Loomis Allen, as president of the firm. Announcement is also made of the change of the firm name to Peck-Shannahan-Cherry, Inc., with offices located at 412-413-414 Syracuse Savings Bank building, Syracuse, N. Y., and 601 Maryland Trust building, Baltimore, Md.

Employes of the **Thomas A. Edison Companies,** West Orange, N. J., have subscribed $1,000,000 to the Fourth Liberty Loan. Mr. Edison and members of his organization have been very active in the support of the loan; full pages have been used in local and nearby metropolitan papers, urging subscriptions, and appealing to the patriotism of the true American to support this loan. In connection with this work, Mr. Edison issued an inspiring message reading, in part, as follows: "Lend more of your money to the country for Fourth Liberty Bonds and manage to live on earnings you have left. You can do it! The loan must come out of every American pocketbook, for the citizens' pocketbooks are the real treasury of the United States."

Edison Electric Appliance Co., Inc., Chicago, held an enthusiastic campaign meeting at its Taylor street works on Oct. 3, giving the Fourth Liberty drive added impetus. A parade, led by a Jackie band from the Great Lakes

Campaign Meeting at Edison Electric Appliance Co. Plant.

Naval Training Station, took its course down neighboring streets, displaying banners of the various departments, many of which went "over the top" in their subscriptions to the loan. A special feature of this meeting was an inspiring address by Corp. N. K. Bruner, of the Rainbow Division, a hero of Chateau Thierry recently returned from France because of his wounds.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., recently issued a two-color, eight-page descriptive booklet entitled "Facts," which describes and illustrates the Dean valve control and its applications to large valves. The booklet lays special emphasis on the fact that by the application of Dean valve control to water mains at strategic points a great deal of the damage caused by bursting water mains may be averted. The Dean valve control consists of a high torque motor which opens and closes the valve gate, a limit mechanism which automatically disconnects the motor at the completion of the gate travel and one or more remote control stations from which the valve can be operated. The valve operating mechanism can be attached to the valve while it is in service and without affecting the service. This control system can also be adapted to large screw type valves and may be used for either municipal or industrial applications where it is desirable to open and close the valve rapidly or to have the control of the valve located somewhat distant from the valve itself.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

BOSTON, MASS.—Plans have been completed by the New York, New Haven & Hartford Railroad Co. for the construction of a new two-story brick signal tower, about 20x24 feet, to be located on First street in the South Boston district of Boston. The structure is estimated to cost $12,000.

CEDAR HILL, CONN.—New York, New Haven & Hartford Railroad Co., Meadow street, has awarded a contract to C. W. Murdock, 185 Church street, for the construction of a new one-story electrical inspection building, about 70x160 feet, at its local properties.

BINGHAMTON, N. Y.—Binghamton Railway Co., under receivership, will extend its lines a distance of 2,000 feet.

BROOKLYN, N. Y.—The United States Government, Navy Department, has had plans prepared for the installation of a new electric system in the nurses' quarters at the local hospital. The department has awarded a contract to A. W. King & Co., Inc., 81 East One Hundred and Twenty-fifth street, New York, for the construction of a new radio compass station at St. George, L. I.

BUFFALO, N. Y. — Worthington Pump & Machinery Corporation has awarded a contract to Henry Harder, 287 Northampton street, for alterations and improvements in the transformer house at its Snow Holly Works at Clinton and Roberts streets, to cost about $5,000.

FIRE ISLAND, N. Y.—The United States Government, Navy Department, has awarded a contract to Frank J. Richards, 160 Jamaica avenue, Brooklyn, for the construction of a new radio compass station at the local Government site.

NEW YORK, N. Y.—Marconi Wireless Telegraph Co. of America, Woolworth building, has entered into a contract with the Chinese Government for the construction of three large new wireless stations at Urumchi and Kashgar, in the province of Sinkiang, and Lanchowfu, capital of Kansu Province, in Central China, and a smaller station at Sianfu, Chensi Province. These stations, which will have greater transmitting power than any at present in China will establish communication between Kashgar and Peking.

NEW YORK, N. Y.—The Government is planning to commence work at once on the remodeling of the Grand Central Palace, Lexington avenue and Forty-sixth street, officially taken over and to be known as Debarkation Hospital No. 5. A large quantity of new electrical equipment will be required in this connection.

NEW YORK, N. Y.—Edison Electric Appliance Co., 147 Waverly place, has filed notice of a reduction in capital from $2,650,000 to $1,812,700.

NORTH EAST, N. Y.—The Borough officials are considering plans for the construction of a new municipal electric plant. Application for permission to erect the plant has been made to the State Public Service Commission, Albany.

WADDINGTON, N. Y.—New York & Ontario Power Co. has recently made application to the International Joint Commission of Canada and representatives for the United States Government for permission to reconstruct its dam at Waddington on the St. Lawrence river.

NEWARK, N. J.—Allweather Train Controller Co., Summer avenue and Crane street, is planning for the installation of a new fire alarm system in its building.

NEWARK, N. J.—H. B. Salmon Co., 357 Grafton avenue, is operating its plant for the production of wire for cables for the Government.

NEW BRUNSWICK, N. J.—The city is considering plans for the construction of a new pumping station at the northwesterly extremity of the city, near Landing bridge on the Raritan river, to increase the capacity of the water works. The plant is estimated to cost $150,000.

CAMDEN, N. J.—New York Shipbuilding Corp. has awarded a contract to Armstrong & Latta, 110 South Broad street, Philadelphia, Pa., for the construction of the proposed pumping house at its plant, Broadway and Fairview avenue. The structure is estimated to cost $35,000.

CAPE MAY, N. J.—Contract has been awarded by the Government, Navy Department, to Cramp & Co., Denckla building, Philadelphia, Pa., for the construction of the proposed power house at the local Government station.

PASSAIC, N. J.—The City Council has awarded a contract to Thomas J. Nolan, Inc., 212 Madison avenue, Passaic, for alterations and improvements in the heating system in the city hall building.

ALTOONA, PA. — Penn Central Light & Power Co. has filed notice with the Public Service Commission of the issuance of bonds for $125,000, to provide for extensions, etc. The Penn Central Light & Transmission Co. has issued bonds for $82,000.

EMPORIUM, PA. — In connection with the construction of the large new sulphuric acid plant recently authorized by the Government, estimated to cost in excess of $1,500,000, it is understood that plans are under consideration for the erection of a power house for operation.

JOHNSTOWN, PA.—Penn Electric Service Co. has recently filed notice with the Public Service Commission of a bond issue for $500,000, a portion of the proceeds to be used, it is understood, for extensions, etc.

KANE, PA.—Kane Electric Light & Power Co. has filed notification with the Public Service Commission of a bond issue for $100,000, and the issuance of common stock for $254,712.50.

PHILADELPHIA, PA.—Ground has been broken by the Publicker-Ward Distilling Co. for the construction of the proposed addition to its boiler plant at Snyder avenue and Water street. Joseph Levin, 1530 South Sixth street, is the building contractor.

PHILADELPHIA, PA. — American Insulation Co., Roberts and Stokley streets, has awarded a contract for the construction of the proposed new one and two-story factory, power plant and office building, about 25x80 feet, the entire work being estimated to cost in the neighborhood of $150,000. The William Steele & Sons Co., 46 North Sixteenth street, is the contractor.

PITTSBURGH, PA. — West Penn Power Co. has commenced the construction of the proposed power generating plant at Springdale, to cost about $5,000,000, for furnishing electric energy for industrial plants, etc., operating in the Pittsburgh district.

PITTSBURGH, PA. — Announcement has been made by the local fuel administration that while all war essential plants operating in the Pittsburgh district are being supplied with sufficient electric energy, there is a demand of from 20,000 to 30,000 additional kilowatts per hour over the amount now being produced. It is understood that the demand is caused partly by semi-essential industrial plants in the district.

PITTSBURGH, PA.—In connection with the large new gun manufacturing plant to be erected on Neville Island, near Pittsburgh, for the Ordnance Department, estimated to represent an expenditure of $140,000,000, considerable new electrical equipment will be required. It is understood that a large power plant will be erected. The new plant is designed to manufacture guns up to 18-inch caliber for both army and navy, the largest ordnance produced, and will be completed and ready for operation before the close of 1919.

READING, PA. — Carpenter Steel Co. has had plans prepared for the construction of a one-story power plant at River Road and Exeter street. Muhlenbery Brothers, 513 Penn street, Reading, are architects.

SCRANTON, PA.—Jefferson Electric Co. has filed notice with the Public Service Commission of the issuance of preferred stock for $50,000, to provide for extensions, improvements, etc.

WASHINGTON, D. C.—The United States Government, War Department,

has had plans prepared for the construction of three new power plants to be located on the Ohio River Dam No. 21, near Morgan, W. Va., Dam No. 24, at Millwood, W. Va., and Dam No. 25, near York, W. Va.

HAMPTON ROADS, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will construct an electric distribution system, to cost $50,000.

HAMPTON ROADS, VA. — The United States Government, Navy Department, has awarded a contract for the construction of a local boiler works, to the Wise Granite & Construction Co., Richmond. The plant is estimated to cost $100,000.

NORFOLK, VA.—Virginia Railway & Power Co. will purchase additional equipment. Address general manager.

CLAY, W. VA.—Clay Utility Co., which recently filed articles of incorporation, has had plans prepared for the construction of a new electric transmission system to extend from the plant of the Central Power Co., Hartland, to Clay, a distance of about five miles. The work is estimated to cost $10,000.

CHARLESTON, S. C.—Charleston Consolidated Railway. & Lighting Co. has awarded a contract to J. A. P. Crisfield Contracting Co., Graves Lane, Philadelphia, Pa., for the proposed extensions and improvements in its plant and system.

CRESCENT CITY, FLA. — $10,000 in bonds will be expended for electric lighting. Address A. D. Lounds, City Clerk.

NORTH CENTRAL STATES.

HAMILTON, OHIO.—Henry Ford's $2,000,000 tractor plant on the banks of the Miami river at Hamilton, Ohio, will be the first of a chain of such factories throughout the country, all of which will utilize water power. The motor manufacturer's plan is to make use of the water power resources of the country in his development of the tractors. The Hamilton plant will develop from 4000 to 5000 hp.

FT. WAYNE, IND. — Crowell-Lundorff-Little Co., Cleveland, Ohio, has received contracts totaling $280,000 for new buildings to be erected by the Pennsylvania Railroad Co. in Ft. Wayne.

INDIANAPOLIS, IND. — Construction work will be begun within the next month on new buildings at Fort Benjamin Harrison, which will cost $2,500,000 and provision will be made for the training of 9000 more men than are at the fort at present. The new buildings will be of semi-permanent construction, two stories high with cement exterior on metal lath and wall board interior finishing, with the best of electrical equipment throughout. An administration building is included in the plans. With the erection of the new buildings Fort Benjamin Harrison will be a training camp for approximately 20,000 engineers.

JEFFERSONVILLE, IND.—United Gas & Electric Co., which operates under an indeterminate permit of the Indiana Public Service Commission in this city, has sued the city of Jeffersonville in the Clark county circuit court for $11,500, alleged to be due for electric light service for street lighting, for police and fire stations and for the city hall from August 1, 1917, to the present time.

DATES AHEAD.

American Society of Mechanical Engineers. Annual meeting, New York City, December 3-6. Secretary, Calvin W. Rice, 29 W. 39th street, New York, N. Y.

American Institute of Consulting Engineers, Inc. Annual meeting, New York City, January 13, 1919. Deputy secretary, B. Etchelle, 35 Nassau street, New York City.

Northern White Cedar Association. Annual meeting, Milwaukee, Wis., January 21, 1919. Secretary, N. E. Boucher, 702 Lumber Exchange, Minneapolis, Minn.

Western Association of Electrical Inspectors. Annual meeting, Chicago, Ill., January 28-30, 1919. Secretary, W. S. Boyd, 175 West Jackson boulevard, Chicago, Ill.

TERRE HAUTE, IND.—An order of the Indiana Public Service Commission which grants the Terre Haute, Indianapolis & Eastern Traction Co. the right to charge a straight five-cent fare removes the last six-tickets-for-a-quarter system in Indiana, for at least the period of the war. The company's net earnings for the fiscal year, ended August 31, 1918, amounted to only $27,535.58, which the Commission found to be entirely inadequate. Wages for conductors and motormen were allowed and the new fare was made more necessary.

SADORUS, ILL.—The village of Sadorus has closed a contract with the United States Electric Co. of Peoria, Ill., for $6000 worth of materials for the installation of electric lights. The contract is contingent upon the ability of the village authorities to sell bonds in the amount of $6000. Current will be supplied by the Central Illinois Public Service Co., which operates in Pesotum, eight miles away, and a wire will be strung between Sadorus and Pesotum.

APPLETON, WIS. — The council has adopted an ordinance for extending the street lighting system. Engineer Arthur J. Sweet, Palace Theatre building, Milwaukee, is preparing estimates.

LITTLE FALLS, MINN.—The property of the Little Falls Water Power Co. has been purchased by L. P. Runkel, H. C. Hornby, H. C. Stevens and A. L. Lynds. Improvements will be made.

MAQUOKETA, IOWA. — Election to vote $65,000 bonds for electrical improvements carried recently. G. C. Anderson, clerk.

ST. LOUIS, MO. — Pan Electric Manufacturing Co., 735 South Fourth street, has had plans prepared for the construction of a new brick, steel and concrete laboratory building, about 60x100 feet. G. P. Wuest, Wainwright building, St. Louis, is architect.

DORRANCE, KANS. — Election to vote $10,000 bonds for electrical improvements.

DOWNS, KANS. — The Solomon Valley power plant has gone into the hands of a receiver and D. G. McGuire, a former owner, has been receiver.

DORRANCE, KANS.—On Oct. 28 the question of issuing $10,000 electric light improvement bonds will be submitted to vote. Address city clerk.

JUNCTION CITY, KANS. — Plans have been completed by Burns & McDonnell, 402 Interstate building, Kansas City, Mo., engineers, for waterworks and sewer extension, to cost $120,000. Bids will be called for soon.

CLARKSON, NEB.—Heningson Engineering Co., Omaha, Neb., engineers, are preparing plans for the new power plant to cost $26,000.

SOUTH CENTRAL STATES.

PADUCAH, KY.—Paducah Traction Co. contemplates expending $25,000 to put its tracks in condition. Roscoe Reed is receiver and A. S. Nichols, manager.

FORT PAYNE, ALA.—The city will vote on the question of issuing $14,000 electric light bonds. Address Tom Sawyer, mayor.

GADSDEN, ALA.—The waterworks pumping station will be equipped by the city for electrical operation; three pumps with motors and other equipment will be installed. Address mayor.

HOWE CITY, OKLA. — $5000 in bonds have been voted to complete the electric light plant. Address mayor.

TULSA, OKLA.—Bids for purchase of bonds of the city to the extent of $575,000 for water extension purposes are being advertised for.

EL PASO, TEX. — Dudley & Orr will rebuild a portion of their power house on Mt. Frank line, which recently burned at a loss of $10,000.

PROVIDENT CITY, TEX.—Texas Electric Railway Co. contemplates extension to camp at estimated cost of $25,000. Address Burr Martin, Dallas, Tex., general manager.

WESTERN STATES.

WHITEFISH, MONT. — Great Northern Railway Co. has awarded a contract to the Mountain States Power Co. for furnishing electric energy for the operation of a turntable at its local roundhouse.

PROVO, UTAH. — Beaver River Power & Light Co. has increased its capital from $400,000 to $1,000,000. The name has been changed to Tilluride Power Co. Extensive improvements will be made.

PORTLAND, WASH.—Pacific Coast Steel Co. has purchased 32 acres as a site for a plant at Wilbridge station, on Columbia river, on the outskirts of Portland, where construction work has commenced. Plant is to be equipped with two open-hearth furnaces of 40 tons capacity each and two rolling mills. Central station power will be used, and all mechanical equipment will be electrically operated. J. P. English is manager of the new plant, with offices in Northwestern Bank building, Portland.

SEATTLE, WASH.—At the request of Councilman Oliver T. Erickson, an ordinance has been prepared providing for a bond issue of $1,050,000 to take up outstanding light department warrants and give the department working capital for necessary extensions.

SEATTLE, WASH.—American Nitrogen Products Co., Securities building, Seattle, has been granted by the Forest Service a preliminary permit for the location of power sites on the Sauk and Suiattle rivers, tributaries of the Skagit, in western Washington. This company is now operating a nitrogen products plant at La Grande, Wash.

SEATTLE, WASH.—Sound Power Co., subsidiary to the Sound Paper Co., both New York concerns, has secured preliminary permit for the development of power on Sultan river, on the National Forest Reserve, in western Washington. H. O. Pond, New York, is president of the company.

TACOMA, WASH. — The city has completed arrangements for the immediate double-tracking of its electric traction system extending to the local shipbuilding plant, to provide additional transportation facilities for workers engaged in the various plants in this vicinity operating on Government contracts. The work is estimated to cost $237,000.

TACOMA, WASH. — The Light & Water Department has had plans prepared for the installation of new equipment to cost about $13,500.

FLORENCE, ORE. — The executive commission consisting of G. G. Bushman, Ernest Walker, Dr. Edwards, J. W. Bergman and Ed Rackleff have been selected to look after business until the Florence Mill, Power & Light Co. has been incorporated.

EUREKA, CAL. — Western States Gas & Electric Co. will supply 80 kw. of electrical energy to the contractor who will raise the steamer *Corona*. This power will be required for about six months.

INGOT, CAL.—Afterthought Copper Co. is planning for the immediate construction of a new electrolytic plant at its mining properties.

LOS ANGELES, CAL. — The Department of Public Service has awarded contracts for the construction of a large power plant at the Haiwee reservoir, about 20 miles from Owen Lake, on the Los Angeles aqueduct. The plant, which is expected to be completed by Jan. 1, is estimated to cost approximately $60,000.

LOS ANGELES, CAL. — The San Joaquin Light & Power Corporation has filed notice of the issuance of $202,761.07 of its series "C" 6 per cent bonds, the proceeds to be used for extensions and improvements in its plants and system. The company is considering plans for the erection of a new substation near California and Orange avenues, for furnishing electric energy to the various large plants in this section of Fresno.

OROVILLE, CAL. — It is reported that the Great Western Power Co. is considering plans for the construction of a large new power house in Butte Valley, to provide for increased capacity. The plant is estimated to cost in the neighborhood of $100,000. Mortimer Fleishhacker is president.

PHOENIX, CAL. — The Salt River Valley Water Users Association has secured a priority rating for the pumping plants to be installed in connection with the proposed irrigation system. It is planned to have a total of 60 pumping plants in operation by June, 1919.

SACRAMENTO, CAL. — Northern California Power Co., San Francisco, is said to be considering plans for the construction of a new electric transmission system from Pitt river to Sacramento.

SACRAMENTO, CAL. — The City Commission has had plans prepared for the installation of a new centrifugal pumping unit, electrically-operated, at the municipal water works, estimated to cost approximately $25,000.

SAN FRANCISCO, CAL. — Plans have been completed by the Board of Public Works for the installation of a new 8-inch centrifugal pumping unit and motor at the Commercial street pumping station.

STOCKTON, CAL.—Stockton Wool Scouring Co. has awarded a contract to the Western States & Electric Co. for supplying electric energy amounting to approximately 150 hp. in motors for a period of five years, to replace the present steam-operated plant.

CANADA.

MONTREAL, QUE.—Capitalists represented by Hon. M. J. O'Brien of Renfrew and Quinlan & Robertson, contractors, are negotiating with the city authorities regarding the establishment of a $12,000,000 hydraulic power plant to develop 40,000 hp. from the Riviere des Prairies, a short distance from this city. It will be necessary to spend $3,000,000 or thereabouts in reconstructing sewer outlets before the work can proceed.

DALHOUSIE, N. B. — Dalhousie Lumber Co. contemplates the construction of an addition to its mill. New equipment, including boilers, sprinklers, motors, feed pumps, etc.

NEW PUBLICATIONS

PUBLIC SERVICE PROPERTIES.—W. S. Barstow & Co., Inc., New York City, has published a handsome, leather bound book of 61 pages entitled "Public Service Properties." The book presents in convenient form general data regarding its public utility companies with yearly gross earnings in excess of $7,800,000. The information regarding these companies, all of which are operated under the regulation of state public service commissions, is accompanied with maps showing the territory served by each utility.

EFFICIENCY IN THE USE OF OIL FUEL.—This is the title of a little handbook of 86 pages intended primarily for the boiler plant and locomotive engineer, who will find in it much valuable information regarding the use of oil fuel. This book has been compiled by the Bureau of Mines, from its own investigations and from leading authorities in co-operation with the United States Fuel Administration. The emergencies of the war have brought before the public with startling directness the need for greater efficiency in the utilization of our mineral resources; and as users of fuel oil have evinced such great interest in helping save fuel, the Bureau of Mines has conducted an educational campaign to develop methods eliminating waste, the results of which are embodied in this handbook. It has been conservatively estimated that one-fourth of the fuel oil, or 40,000,000 barrels, may have been saved in 1917 by more intelligent operation of plants and by proper firing. This pamphlet contains valuable engineering advice in the design and operation of plants and clearly sets forth numerous principles, which if carefully observed by users of fuel oil, will result in a great reduction of fuel consumption. The handbook contains many tables and formulas as well as charts. The price of this publication is 15 cents, and copies may be had by addressing a request to the Superintendent of Documents, Government Printing Office, Washington, D. C.

PROPOSALS

POLE LINE SYSTEM.—Bids will be received at Crescent City, Fla., by the undersigned November 9, for the following: One distributing pole line system, complete, as outlined in specifications and map on file in the office of the clerk of the town of Crescent City, Fla.; one single story frame power house building, as outlined in plans and specifications, also obtainable as above. Power house equipment as outlined in plans and specifications also obtainable as above. All bids are to be made to include all labor and material incident to erecting and furnishing in first class manner the items as above. Address F. L. Bills, secretary of the Board Bond Trustees, Crescent City, Fla.

INCORPORATIONS

DOVER, DEL.—Specialty Products Company. Capital, $100,000. To manufacture electrical machinery, etc. Incorporators: M. M. Clancy, and F. A. Armstrong, Wilmington.

NEW YORK, N. Y.—Standard Appliance Company of America. Capital, $95,000. To manufacture telephone apparatus, etc. E. Goodman, J. L. Volz, and N. Shaw, 32 Cooper Square, are the incorporators.

CLARKSBURG, W. VA.—McDonald Storage Battery Company. Capital, $10,000. To manufacture storage batteries, etc. Incorporators: Frank C. Welch, M. E. McDonald, and John F. Kearns.

CLEVELAND, OHIO. — Duquesne Transit Co. has incorporated with a capital of $20,000 by L. E. Jones, H. L. Benton, Alfred Clum, M. A. McManus and Anna L. Kinsella.

MONTVERDE, FLA. — Montverde Telephone Company has been incorporated with a capital of $5,000. R. W. Harper, President.

FLORENCE, ORE.—Florence Mill Power & Light Co. has been incorporated with a capital of $30,000.

WILMINGTON, CAL. — Harbor Electrical Company has filed notice of organization to operate at 1026 East Anaheim Road for the manufacture of electrical supplies. Frank McGinley, 117 North Fries street, Wilmington, heads the company.

ONTARIO, CAL.—Ontario Power Company is having plans prepared for the construction of a power house in the San Antonio canyon above Hogsback, to cost about $60,000. Glenn D. Smith is general manager.

Recent Patents

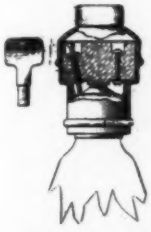
Selected and Summarized by Albert Scheible, Patent Attorney, 79 West Monroe Street, Chicago, Illinois

A series of brief comments on some of the recently issued electrical patents which appear to be of particular interest to our readers, the number after each heading being that of the United States patent to which the summary relates. Any correspondence regarding such patent matters should be sent direct to Mr. Scheible at the above address.

Electric Heater Unit (1,278,484.)—Insulating tubes are joined to an insulating hub to form a spider, and high-resistance wires are then wound in grooves upon these tubes. Patented by Leslie V. Leonard, of Richmond, Victoria, Australia.

Wireless Transmitting System (1,278,507-1,278,508).—In using a condenser in connection with a spark gap, Oscar C. Roos (of Allston, Mass.) places arresters at either side of the gap to prevent the condenser from discharging across the latter.

Locking Lamps in Sockets (1,277,533).—To lock a lamp in a socket, Reuben B. Benjamin (of the Benjamin Electric Mfg. Co., Chicago) provides a screw which extends through the insulating body of the socket.



No. 1,277,533.—Lamp Lock.

This screw is reached by a suitable key through an opening in the cap of the socket, so that it can be screwed against the base of the lamp.

Motor Construction (1,278,096).—In the electric motor patented by Joseph Bijue, a number of brushes are biased towards a commutator and are controlled as to their position by separate devices, while a single cam is so arranged as to move all of the brushes successively against the commutator. The patent was assigned to the Bijue Motor Appliance Co., a Delaware corporation.

Current Transformer (1,278,121).—Instead of winding the primary and secondary coils of a transformer on each other, Richard C. Downing (of Syracuse, N. Y.) and Lloyd C. Nicholson (of Buffalo) support these windings out of contact with each other, making the space between them sufficient to form an air dielectric which will resist high-potential breakdown stresses.

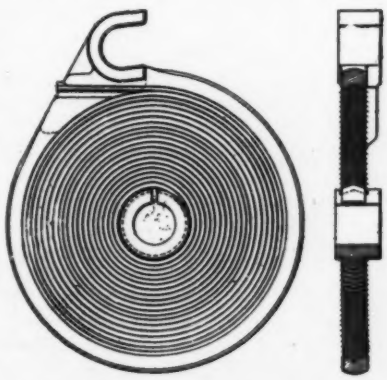
Regenerative Control (1,278,143).—To control a group of momentum-driven dynamos, Arthur J. Hall (of Wilkinsburg, Pa.) provides automatic means for selectively grouping them in parallel or series connection to the supply circuit, the automatic shifting of the connections being dependent upon the initial regenerative speed and the consequent voltage conditions of the dynamos. (Patent assigned to the Westinghouse Electric & Mfg. Co.)

Electric Hammer (1,278,359).—In the hammer devised by Victor E. Lane (of Detroit) the blows are transmitted to the tool through impact rollers. These rollers are engaged successively by projections on a continuously rotating striker.

Electrothermal Robe (1,278,530).—In the electrically heated robe devised by Howard H. Wallace (of Salt Lake City, Utah) resistance wires are stitched on one face of the garment and the snap fasteners close the circuits.

Electric Welding (1,278,193).—In welding metal parts to each other, Joseph B. Murray (of Brooklyn, N. Y.) electrically heats them to a welding temperature while pressing them together. Then he discontinues the current, but maintains the pressure until the metal parts have cooled below the critical temperature of structural change.

Resistance Unit (1,275,785).—Flat and compact resistance units can be made by simply coiling a resistance strip with a layer of insulation between the successive turns, but the expansion and contraction due to the heating may tend to slip the strip out of position sideways. To prevent this, Harry F. Stratton, of Cleveland (according to this patent, assigned to the Electric Controller & Mfg. Co.), makes the strip angular in cross-section and surrounds the finished flat coil with a ring which holds the unit tightly coiled.



No. 1,275,785.—Flat Resistance Unit.

Electric Backspacer for Typewriter (1,278,324). A solenoid is provided to operate the carriage in the reverse direction from that normally used in letter spacing. This solenoid is controlled by two switches, one operated by a key and the other by the carriage. This patent was granted to Hubert P. Fraenzl, Tacoma, Wash.

Commutator (1,278,201).—In the commutator construction patented by John W. Pearson, of Chicago, the segments are all clamped between two suitably shaped rings. One of these rings has a tubular extension housed by the other. This extension is then welded to the other ring after the parts are assembled. To repair the commutator, the welded end is chipped or filed off, and after the repairs are made, the rings are again welded to each other.

No. 1,278,201.—Commutator Construction.

Pendent Switches (1,278,780-1,278,781).—Two types of double push switches arranged for use on drop cords are shown in these patents, both assigned by Clarence C. Stirling to the Hart & Hegeman Mfg. Co., of Hartford, Conn.

Electric Furnace Operation (1,278,635).—In melting and refining metal, James H. Gray (of New York City) first supplies current of comparatively high voltage to the electrodes, using a reactance in the circuit to prevent surges in the power line. Afterwards he cuts out the reactance and employs a lower voltage during the finishing or refining period.

Proportioning Motor Loads (1,278,192).—To govern the load distribution between a number of series motors, Thomas F. Mullaney and Walter J. Quinn (both of New York City) arrange controlling circuits for governing the magnetic flux so as to equalize or proportion the work of the motors. They then change the connections of the motors from series to multiple, and simultaneously render the controlling circuits dead. These circuits are then kept dead until the motors are returned to series connection.

Personal

M. L. Pomares Joins William J. Shore—C. W. Ward Resigns —Changes in Milwaukee Light & Heat Personnel—Changes

FRANK. J. BURD, formerly sales engineer of the central district, Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has accepted a position with the Cambria Steel Co., Youngstown, Pa., as assistant electrical superintendent.

W. J. MCDOWELL has severed his connection with the electrical industry to become manager of the machine tool department of the Fairbanks Co., 64 E. Lake street, Chicago. The Fairbanks company is one of the largest merchandising concerns in the United States, handling machine tools, railroad machinery, mill supplies, valves and kindred lines.

GEORGE MCD. JOHNS, formerly chief electrical engineer of St. Louis, Mo., in charge of the fire and police telephone and telegraph system, has associated himself with W. N. Matthews & Brother, whom he will serve in the capacity of production manager. Mr. Johns is widely known in electrical circles, and is now serving his third successive term as secretary and treasurer of the St. Louis Jovian League.

CHARLES E. GOODNOW, formerly assistant sales manager of the electrical and special wire department of the American Steel & Wire Co., and more recently identified with building construction work in Washington and Brooklyn for the army and navy, is now with the Page Steel & Wire Co., 30 Church street, New York. Mr. Goodnow's efforts will be devoted to sales and service on Armco iron welding rods and "Copperweld" wire.

C. W. WARD, superintendent of laboratory, Duquesne Light Co., Pittsburgh, Pa., recently became connected with the Citizens' Light & Power Co., Oil City and Franklin, Pa., in the capacity of superintendent of light and power. Mr. Ward was connected with the Duquesne Light Co. for the past seven years, during which time he taught electric wiring at night at the Carnegie Institute of Technology. He at one time served as president of the Duquesne Light Co. Section of the N. E. L. A., and in 1912 as chairman of the lamp committee of the Pennsylvania Electric Association.

H. A. MULLETT and G. W. VAN DERZEE have been appointed assistant general managers of the Milwaukee Light & Heat Co., Milwaukee, Wis., by Col. S. B. Way, vice-president of the company. Both these gentlemen have been in the service of the company for a number of years, Mr. Mullett entering the service as an assistant to E. W. Olds in the rolling stock department. On the resignation of Mr. Olds six years ago he was made superintendent of rolling stock and in that capacity has had charge of the maintenance of the care and the company's extensive shops including the building of new cars. Mr. Van Derzee for the past six years has been assistant to the vice-president. He is an electrical engineer and a graduate of the University of Wisconsin.

R. A. HOCK, traveling auditor of the United Gas & Electric Engineering Corp., New York, has been appointed auditor of the company to succeed George F. Bauer, resigned.

T. RANDALL DU BOIS has resigned as engineer of the Bijur Motor Lighting Co., Hoboken, N. J., to accept a position with the U. S. Light & Heating Corp., of Niagara Falls, N. Y.

M. V. GRAMMER, for some time a member of the commercial department of the Citizens' Gas & Fuel Co., of Terre Haute, Ind., has been transferred to the commercial department of the Union Gas & Electric Co., Bloomington, Ill.

HENRY R. STEVENS and ROBERT L. ROCKWELL, heretofore constituting the electrical and mechanical engineering firm of Stevens & Rockwell, Empire building, Seattle, have dissolved their partnership. Mr. Stevens has accepted the position of electrical engineer for the Seattle division of Stone & Webster interests. Mr. Rockwell succeeds to the business of the firm, and it will be continued at the same offices.

M. L. POMARES has resigned from the Department of Water Supply, Gas & Electricity of New York City, and has joined the organization of William J. Shore, electrical contracting engineer of New York City. Mr. Pomares has studied electrical engineering at Columbia University. He was a member of the National Electric Light Association, New York Electrical Society and the executive committee of the National Association of Electrical Inspectors. He has written several articles on various subjects directly connected with the installation of electrical equipment. Mr. Pomares will be assistant engineer to Mr. Shore and will be of valuable assistance in the building up of his organization.

Obituary.

COUNCILMAN ROBERT MUNN DIXON, East Orange, N. J., president of the Safety Car Heating & Lighting Co. of Jersey City, died on October 16, at his home, 27 North Walnut street, aged 58 years. Mr. Dixon was a trustee of the United Engineering Society of New York.

W. H. FAIRCLOUGH, SR., for many years identified with the electrical industry, passed away on Oct. 14 at his home, 1027 Argyle street, Chicago. Mr. Fairclough was born in Liverpool, England, on Feb. 15, 1836, and came to this country in early childhood. In 1885 he entered the service of the Western Edison Light Co., then doing business at 185 Dearborn street, acting as the selling agent of the company. He was later made general agent, with a territory consisting of Cook County and Milwaukee, and in this capacity established a remarkable sales record. From 1889 to 1891 Mr. Fairclough was general agent in Chicago for the Westinghouse Electric & Manufacturing Co., but with the exception of the two-year lapse he had been connected with the Commonwealth Edison Co. and its predecessors continuously since 1885. He retired from active service several years ago. He is survived by his wife, a daughter, Mrs. H. W. Goode, and a son, W. H. Fairclough, Jr., of the Commonwealth Edison Co.

JONATHAN CAMP, president and general manager of the Franklin Electric Manufacturing Co., manufacturer of the Franklin Mazda lamp, died at his home in Hartford, Conn., on Oct. 13. He was a victim of the Spanish influenza epidemic, having been taken ill but one week before his death, but in three days developed pneumonia from which he was unable to rally. Mr. Camp was born in Norfolk, Va., on Jan. 10, 1874, and was educated at Williams College. He began his business career in the hardware field in Hartford, Conn., but later became interested in the electrical industry through the Perkins Electric Switch Co. of Bridgeport, with which he was connected. A few years ago Mr. Camp and the late C. I. Hills purchased the lamp manufacturing business and the Perkins company and formed the Franklin Electric Manufacturing Co., Mr. Hills acting as president and Mr. Camp as treasurer and general manager. After Mr. Hills' death, Mr. Camp became president and held this office until his death.

HARRY J. PEPPER, superintendent of the Urbana and Champaign Railway, Gas & Electric Co., Champaign, Ill., died at his home in that city Oct. 17, after a 10 days' illness, due to complication of diseases. His condition was aggravated by leakage of the heart and his case was serious from the beginning of his illness. Mr. Pepper had been associated with the electrical industry in Champaign for 29 years, taking charge of the work of the street railway and electric light plant there for the Harris interests in 1889. When the McKinley interests acquired the local utility business in Champaign and organized the Illinois Traction System, Mr. Pepper was retained as superintendent of his original work, the company then being known as the Urbana and Champaign Railway, Gas & Electric Co. During the 29 years he was engaged in the electrical business in Champaign Mr. Pepper witnessed many transformations and enlargements of his work, the street railway, electric lighting, heating and gas utilities being generally enlarged on account of the growth of Champaign and Urbana and especially by the development of the University of Illinois. The latter institution grew from about 500 students in 1889 to 6,000 students in 1918, and no business in the Champaign-Urbana business field showed more development than did the Urbana and Champaign Railway, Gas & Electric Co. Mr. Pepper was a prominent Mason and a member of the Champaign Rotary Club.

After the War, What ?

VIII.

The Big Question for Us

Great Britain is getting ready for the game that must be played after the war game is closed. She is getting ready in a comprehensive way that is a credit to her business foresight.

So far as I know, no other nation is preparing such an ambitious programme in a formal and official way. Italy has made a faint beginning. France is thinking about it. What Germany is doing we do not know, but we may be dead sure that the Hun is not sleeping over the problems of reconstruction after the war. Germany will be ready to "sit in" so far as she is permitted.

In the world reconstruction that will follow peace Great Britain does not propose to be caught napping. Already she has organized a "ministry of reconstruction." It is a regular part of the great British government, clothed with adequate powers, and with a definite job before it backed by the resources of the empire.

This ministry has started a world-wide investigation, issued some striking reports, and is quietly but seriously getting ready for the future.

However, the question for us is what are we doing to get ready for the great domestic and international reconstruction period? If we blunder along and take chances we shall suffer. The time to get ready is now. The best brains (and advertising experience) of the nation should be mobilized for this business at once. It will not be a credit to our American common sense if we are caught napping.

R. A. WHITE.

ARE we leaving our trade and our advertised products to "take care of themselves," after the war, as certain near-statesmen from the South advocate? Think it over.

C. A. Tupper, President . CHICAGO
INTERNATIONAL TRADE PRESS, Inc.

Financial News

Fixing Utility Valuation.

By John W. Alvord.

The writer discusses the effect of the world war on practices used in making valuations of utility properties. He says, in part:

"The war has brought vividly to those engaged in valuation work the important conclusion that value, as a conception to be practically realized, is, after all, a thing always very dependent on what is yet to come. So wound up is it with what is yet to be, so dependent is it on the next stage, that it is no wonder it seems indefinite and elusive. So suddenly has this conviction been forced upon us by the war that numbers of those interested in the subject are either quietly discouraged or openly skeptical as to whether any real principle of valuation is permanent and enduring.

"Now, it is not at all true that the principles of valuation have been undermined or destroyed by recent experiences. The misapprehension is due to the fact that there has been too little of the broader grasp of the subject and too little understanding that valuation depends upon human judgment derived from incomplete data and not at all upon a formula or a rule of mathematics. Out of the war we have learned that in valuation work we must consider the future more and the past less. Too many of our commissions, courts and appraisal investigators base valuations of utilities on past cost, oblivious to all future conditions.

"Intrinsic values of a utility at some past time can be most closely determined because in the meantime the future supply and demands have become known and our foresight has become hindsight, thus eliminating all uncertainties of prophecy.

"But the intrinsic value of a thing at some past time is not commonly desired or especially useful in fixing present public utility values. We wish in regulating rates of public utilities to regulate rates of the near future not of the past, and in purchasing a public utility plant we wish to know the intrinsic value in the near future, rather than in the past, and to know the intrinsic value of a utility plant for the future we must know how much its service will be needed in the future and if there will be a growing desire for its product by a prosperous community, or a diminishing desire from a declining population.

"Strictly speaking, the actual past cost investment of a utility lacks all the significance unless of recent construction, or unless such past cost investment has been increased by all its appreciations of value and decreased by all its losses.

"The latter method theoretically should give us the present reproduction cost less depreciation, and provided the public needs and their source of supply continue in a state of equilibrium, this theoretically should be equivalent to intrinsic value."

Western Union to Receive $8,000,000 Annually.

Postmaster General Burleson recently entered into a contract with the Western Union Telegraph Co., respecting compensation for the use of the land line properties during the period of Federal control, the salient features of which are:

1. The contract leaves to the company its non-operating income and the income from its eight trans-Atlantic cables.

2. The Government to maintain all land line reserves for depreciation and amortization upon the same bases as heretofore; to continue the maintenance and operation of the property in as efficient condition as when taken over and to return the property, on the termination of Federal control, in as good condition as when received; to pay all other land line operating charges, including taxes, bond interest and guaranteed rentals and dividends; and to continue the company's plan for pensions, disability and death benefits.

3. As compensation, the Government will pay the company the sum of $8,000,000, per annum. Out of such compensation the company will loan to the Government each year the sum of $1,000,000, without interest, toward financing approved additions and extensions, funds required for these purposes beyond such amount to be furnished by the Government. If new securities are issued by the company for land line additions or otherwise required, the Government will pay the interest or other costs of such securities. The company to limit its dividends during Federal control to 7 per cent.

4. On the basis of returns for the first eight months of this year, it is estimated that the company's net income for the calendar year 1918 will be approximately $11,500,000.

5. Viewed in every aspect, the contract is a fair one to the company and the Government, and the arrangement was reached through the pursuit of a broad policy by both parties to the negotiation.

Dividends.

Fort Worth Power & Light Co. has declared a quarterly dividend of 1¾ per cent on preferred stock, payable November 1, to stock of record October 20.

Public Service Investment Co. has declared a quarterly dividend of $1.50 on preferred stock, payable November 1 to stock of record October 17.

Illinois Northern Utilities Company has declared a quarterly dividend of 1½ per cent on preferred stock, payable November 1 to stock of record October 19.

Idaho Power Company has declared a quarterly dividend of 1¾ per cent on preferred stock, payable November 1 to stock of record October 19.

Earnings.

COLUMBIA GAS & ELECTRIC.

Consolidated earnings and expenses for September, 1918:

Gross earnings	$835,824
Operating expenses and taxes	452,903
Net operating earnings	382,921
Other income	163,156
Total net earnings and other income	546,078
Lease, rentals, etc.	300,071
Fixed charges—Columbia Gas & Electric Co.	59,445
Surplus	186,560

SOUTHWESTERN POWER & LIGHT.

The properties now controlled by the Southwestern Power & Light Co., intercompany charges eliminated, reports for August:

	1918.
Gross earnings	$ 475,830
Net earnings	152,784
Twelve months:	
Gross earnings	$5,275,655
Net earnings	2,066,607

NEW JERSEY POWER & LIGHT CO.

For September—	1918.	1917.
Operating revenue	$27,143	$18,564
Operating expenses and taxes	16,502	11,185
Operating income	$10,641	$ 7,379
9 Months Ending September 30th—	1918.	1917.
Operating revenue	$212,373	$160,066
Operating expenses and taxes	140,334	100,118
Operating income	$ 72,039	$ 59,948

INTERBOROUGH RAPID TRANSIT.

For July—	1918.	1917.
Net operating income	$1,227,989	$2,911,301
Net corporation income	228,031	451,788
Gross income	1,187,285	1,260,158
Net corporation income	228,031	451,788

WEEKLY COMPARISONS OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities—	Div. rate. Per cent.	Bid. Oct. 15.	Bid. Oct. 22.
Adirondack Electric Power of Glens Falls, common	6	13	12
Adirondack Electric Power of Glens Falls, preferred	6	..	..
American Gas & Electric of New York, common	10+extra	80	80
American Gas & Electric of New York, preferred	6	39	39
American Light & Traction of New York, common	..	196	235
American Light & Traction of New York, preferred	6	92	95
American Power & Light of New York, common	4	40	40
American Power & Light of New York, preferred	6	68	68
American Public Utilities of Grand Rapids, common	..	..	12
American Public Utilities of Grand Rapids, preferred	6	35	35
American Telephone & Telegraph of New York	..	108	196½
American Water Works & Elec. of New York, common	..	5¼	6
American Water Works & Elec. of New York, particip	7	12	13
American Water Works & Elec. of New York, first preferred	..	59	61
Appalachian Power, common	..	3	2
Appalachian Power, preferred	7	20	18
Cities Service of New York, common	+extra	250	300
Cities Service of New York, preferred	6	74	76
Commonwealth Edison of Chicago	8	108	109
Comm. Power, Railway & Light of Jackson, common	..	23	23
Comm. Power, Railway & Light of Jackson, preferred	6	45	43
Federal Light & Traction of New York, common	..	7¼	7¼
Federal Light & Traction of New York, preferred	..	35	35
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	26	25
Middle West Utilities of Chicago, preferred	6	46	50
Northern States Power of Chicago, common	..	46	52
Northern States Power of Chicago, preferred	ex.div.7	81	84
Pacific Gas & Electric of San Francisco, common	..	36½	38
Pacific Gas & Electric of San Francisco, preferred	6	80	82
Public Service of Northern Illinois, Chicago, common	7	80	80
Public Service of Northern Illinois, Chicago, preferred	6	84½	81
Republic Railway & Light of Youngstown, common	4	17	18
Republic Railway & Light of Youngstown, preferred	6	55	55
Standard Gas & Electric of Chicago, common	..	5	7½
Standard Gas & Electric of Chicago, preferred	6	24	31
Tennessee Railway, Light & Power of Chattanooga, common	..	2½	2
Tennessee Railway, Light & Power of Chattanooga, preferred	6	11	12
United Light & Railways of Grand Rapids, common	4	29	34
United Light & Railways of Grand Rapids, preferred	6	60	64
Western Power of San Francisco, common	..	11	11
Western Power of San Francisco, preferred	6	48	50
Western Union Telegraph of New York	extra	92	92
Industrials—			
Electric Storage of Philadelphia, common	4	49½	54
General Electric of Schenectady	8	157	157
Westinghouse Electric & Mfg. of Pittsburgh, common	7	44½	45
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	60	63